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COMMENTARIES

UPON

BOERHAAVE'S

APHORISMS

CONCERNING THE

KNOWLEDGE and CURE of DISEASES.

BY

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COMMENTARIES

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Of WOUNDS in the THORAX.

§. 297. THAT wounds inflicted in the thorax have *not* penetrated its cavity, is discovered by inspection, by the probe, by no air being discharged by any means, by the return of liquors injected warm, by placing the body in the same posture as when it received the wound, and by certain signs that the lungs adhere to that part of the pleura which the wound has penetrated.

The *Thorax* is that part of the trunk of the body which is terminated before by the sternum, behind by the twelve vertebræ of the back, on the sides by the arched ribs, above by the two superior ribs, and below by the diaphragm, which separates it from the cavity of the abdomen. But as the diaphragm is placed obliquely, and forms a kind of arched roof, in such a manner that its fore-part rises much higher than its back-part, which is inserted lower, it is thence evident that the cavity of the thorax is much larger behind than before. Internally this whole cavity is lined on all

ſides with a very ſmooth membrane termed the *pleura*, which in a manner forms two hollow bladders, (as we explained it in §. 170. n° 4.) attached cloſe to each other near the ſternum, ſo as to partition the cavity of the thorax into two; and betwixt the meeting of theſe two pleuræ, is placed the pericardium with its incloſed heart, making the third chamber or cavity of the thorax.

Now in all wounds of the thorax, the firſt inquiry ought to be, Whether they have penetrated its cavity or not? When the wounding inſtrument has perforated the membrane of the pleura, or the pericardium, the wound may be then ſaid to have penetrated the cavity of the thorax; otherwiſe, not. But a wound inflicted in the thorax may be very dangerous, and injure a great many parts, without entering its cavity: for the pleuræ, having reached the ſides of the column of the vertebræ, recede on each ſide from the ends of the ribs; and, riſing up, leave a conſiderable ſpace, which is occupied by the cellular membrane, through which the œſophagus, aorta, thoracic duct, *&c.* paſs. Therefore all the parts here placed may be injured, though the wound does not penetrate into the cavity of the thorax. It will eaſily appear, however, that this muſt very ſeldom be the caſe, ſince theſe parts are defended pretty ſecurely by the column of the vertebræ behind them. But that a wound has *not* entered the cavity of the thorax, but only injured the external parts, may be known as follows.

By inſpection.] That is, when the wound is ſufficiently large, and runs in a ſtraight courſe.

By the probe.] Which, being formed either of lead or ſoft ſilver, is to be introduced through the apertures of the wound, without any force or violence. But it is eaſily apparent, that a change in the ſituation of the body, or the fat, concreted blood, *&c.* ſtopping up the wound, may eaſily obſtruct the paſſage of the probe, and afford a reſiſtance to the touch, notwithſtanding the wound does penetrate into the cavity of the thorax.

No air being diſcharged by any means.] It was ſhown in the comment on §. 170. n° 4. that the ſurface of

of the lungs is always exactly contiguous to the pleura while the cavity of the thorax remains entire, and that no air at all is contained betwixt the lungs and the pleura; but when a wounding inſtrument has perforated the pleura, the air may then enter and compreſs that ſide of the lungs, and thus part of the ſpace before occupied by the lungs will now be filled with external air. Now this air being rarified by the heat of the parts, will in part eſcape through the wound, and more air will enter again; ſo that the air will continually enter and return by the wound: and this more eſpecially if the perforation of the pleura is not very large; for then the lungs may be in ſome degree dilated by the air entering through the glottis, as we explained more at large in the place above cited. In wounds of the thorax, therefore, a ſkilful ſurgeon always inquires whether the air ruſhes impetuouſly through the wound; and this chiefly in the following manner. After he has compreſſed or cloſed the lips of the wound with his thumb or fingers, ſo that no air can enter or return by it, he then orders the patient to inſpire as much air as he well can, and to retain it in his lungs by ſhutting the larynx; and then, before the patient breathes out the air, he places a wax-candle oppoſite to the wound, and ſuddenly opens its lips: if, now, any air entered into the cavity of thorax, it will be forcibly blown out thro' the wound, ſo as to move the flame of the wax-candle. For the air that had entered into the cavity of the thorax by the wound, being now confined by the cloſure of the lips of the wound, will be rarified by the heat of the body; and the lungs of the ſame ſide being alſo dilated by a violent inſpiration, and the inſpired air rarified by its retention and the cloſing of the glottis, this will expand the lungs, ſo as to increaſe the compreſſure of the air contained in the cavity of the thorax: hence it will ruſh out impetuouſly and with a noiſe, ſo ſoon as a free paſſage is given to it by opening the lips of the wound. Now it is evident, that if the air thus ruſhes through the wound, the cavity of the thorax muſt certainly have been perforated: but then the thorax may be perforated, and no air be thus diſcharged,

becauſe, by changing the poſture of the body from that in which it received the wound, the fat or fleſh may occlude the perforation; ſo that though a little air might have been admitted into the thorax, yet it cannot eaſily eſcape again, for the ſame reaſon. This holds true more eſpecially when the wound penetrating into the thorax is ſmall or narrow: and from hence we are therefore enabled to judge how far this ſign may be relied upon with certainty.

By the return of warm liquors injected.] This ſeems to be the moſt certain and ſafe method of determining the queſtion. For the ſearch by the probe may often be fallacious; ſince changing the poſture of the body may in a fat perſon occlude the perforation by the cellular membrane, which will obſtruct the probe from reaching to the bottom of the wound. And ſometimes the probe may go near its whole length into the wound, without entering the cavity of the thorax; the wounding inſtrument having ſlid over the ribs into the fat, as we are taught by chirurgical obſervations. A ſtudent was ſo wounded in the right ſide of the thorax by a ſword, in ſingle combat, that the wound, inflicted in the ſide as the body preſented obliquely, came out on the left ſide of the thorax, without at all entering its cavity, becauſe the ſword ſlid over the ribs. Warm water is to be injected by a ſyringe through the mouth of the wound with a moderate force: and if a conſiderable quantity of water may be thus injected without any reſiſtance or apparent tumour in the cellular membrane, we then know that the water paſſes by the wound into the cavity of the thorax; but if a conſiderable reſiſtance is immediately felt, and the injected water returns by the mouth of the wound, this ſhews the contrary. Nor is any hurt to be feared from this trial, even though the warm water injected ſhould paſs into the cavity of the thorax; for it may be eaſily diſcharged again from thence by a convenient poſture of the body, and by the means we ſhall hereafter deſcribe in §. 303: or even if it is left there, it will be abſorbed by the bibulous veins opening throughout the whole ſurface of the lungs and pleura; and that liquors contained

tained in the cavity of the thorax may be thus carried off, we are taught by frequent experience. In an empyema, the matter has been found to be this way abſorbed, and diſcharged with the ſaliva, urine, or by the inteſtines; and the ſame matter entering by the veins, and mixing with the blood, has been often tranſlated and ſettled upon divers other parts of the body. And thus Parey was ſurpriſed, after injecting a little liquor into the thorax to deterge and cleanſe the cavity, that the wounded perſon ſhould perceive an extreme bitter taſte, and have an inclination to vomit[a]; and therefore he abſtained from his medicines.

Poſture of the body, *&c.*] What conſiderable uſe a knowledge of the poſture of the patient's body when wounded may be of, towards determining the nature of the wound, and preſaging the conſequent maladies to be feared, we have already declared in the comment on §. 168. nº 1. For frequently it is altogether impoſſible to diſcover the courſe of the wounding inſtrument betwixt the parts of the body, unleſs the patient is placed in the ſame poſture as when he received the wound. For the various actions of the muſcles may wonderfully change the ſituation of the parts; as Euſtachius has well expreſſed in his anatomical tables, in the thirtieth of which the right arm is ſhown elevated and the cubitus inflected, the left arm extended with the cubitus turned downward: If now we compare the right and left ſides of this figure, we ſhall ſee a conſiderable difference in the poſture of the parts.

By certain ſigns that the lungs adhere, *&c.*] Though the lungs, during life, always remain contiguous to the pleura, as well in exſpiration as inſpiration, as we are aſſured from phyſiology; yet the lungs are naturally at free liberty in the cavity of the thorax, adhering to the trachea by its air-veſſels, and to the heart by its blood-veſſels, but in no part naturally adhering to the pleura. Now the chief cauſe which prevents theſe parts from growing to each other, ſeems to be a thin dew or moiſture which is cotinually exhaled every moment of life from ſmall arterial ducts, which open throughout the

[a] Liv. x. Chapit. 32. p. 251.

whole ſurface of the lungs and pleura, and prevent the concretion of one with the other. And this circumſtance we find is beautifully obſerved by Hippocrates, with his uſual brevity or conciſeneſs of expreſſion, when he ſays, *For every part of the body which is not ſolid or grown together, but lined either with ſkin or fleſh, is hollow; and in a healthy ſtate is repleniſhed with vapours, but in a morbid ſtate contains ichor* [b]. But when the larger veſſels are ſo diſtended in an inflammation, as to compreſs theſe ſmall exhaling arteries, they will not then be able to diſcharge their thin liquor, but the dry ſurfaces of the inflamed membranes ſpeedily cohere together; whence it is that we ſo often meet with adheſions of the lungs to the pleura, after a pleuriſy, peripneumony, empyema, *&c.* If therefore it ſhall appear that the wounded patient has been afflicted with theſe diſorders, we ought then to think of this adheſion: for if the wound entered a part of the thorax where the lungs adhered to the pleura, the inſtrument in that caſe might paſs a conſiderable length into the ſubſtance of the lungs, without perforating the cavity of the thorax. But this may be known, if the water injected by the mouth of the wound with a ſyringe, excites a cough, and is diſcharged through the windpipe; for in this caſe the wound has entered the lungs without penetrating the cavity of the thorax.

Theſe are the ſigns by which it is uſually determined whether the wound has injured the external parts only, or alſo penetrated into the cavity of the thorax. But it may ſometimes happen, that all theſe ſigns, tho' accurately examined, may prove fallacious: eſpecially if the wound was inflicted by a narrow inſtrument; for then the fat may ſo cloſe up the wound after the inſtrument is extracted, that it will neither afford a paſſage to the air, probe, or injected water, and yet the wounded veſſels of the lungs may extravaſate their blood into the cavity of the thorax. It will therefore be neceſſary, at the ſame time, to conſider whether the reſpi-

[b] Omne enim non concretum, ſive cute, ſive carne tegitur, cavum eſt, impleturque ſanum quidem ſpiritu, infirmum vero ichore. *Hippoc. de Arte, cap.* 8. *Charter. Tom. II. p.* 150.

reſpiration is affected; for if the cavity of the thorax be leſſened by the ingreſs either of air or of extravaſated blood, the reſpiration will always become more difficult: and if this ſymptom appears after a wound inflicted in the thorax, there is ſome reaſon to ſuſpect the wound to be both dangerous, and to have perforated the cavity of the thorax, even tho' no other ſymptoms are ſeen. The utmoſt caution is here neceſſary, leſt the ſurgeon or phyſician ſhould incur diſcredit, by miſtaking a dangerous or even fatal wound in this part for one of little or no moment.

§. 298. IF the wound (297) deſcends obliquely above or within the ribs; even then matter is frequently depoſited in the cavity of the thorax by an eroſion of the pleura, and this more eſpecially if the egreſs of the matter by the external wound is any how impeded: and thus an empyema is formed, from whence ariſe many bad conſequences.

Though it appears evidently that the wound does not penetrate into the cavity of the thorax, yet the worſt ſymptoms may notwithſtanding follow. For if the wound deſcends deeply among the muſcles, and its orifice lies higher, the extravaſated humours will be therein collected, ſtagnate, and corrupt, ſo as to form various ſinuſes; and, after eroding the pleura, it may at length paſs into the cavity of the thorax: the matter having once found a vent into the thorax from the ſinous ulcer, will be daily augmenting ſo as to form an empyema; and the lungs thus ſoaking in corrupt matter, which becomes daily more acrimonious, will be themſelves conſumed; ſo that, after the greateſt calamities, death itſelf will follow. The maladies we now ſpeak of are always the worſt, when a ſinous ulcer of this kind runs behind the ribs; for then there is no opportunity either to compreſs the parts, or dilate the wound, to promote the diſcharge of matter. And if the boney or cartilaginous ſubſtance of the ribs and

ſternum

ſternum are affected, many other bad conſequences may again follow from thence, ſo as to render the cure extremely difficult; as will be more apparent when we come to treat of diſeaſes in the bones. In confirmation of this, we have a remarkable inſtance given us by Galen[a]. A lad received a blow upon his ſternum in the field of exerciſe: it was firſt neglected, and afterwards badly healed; but four months afterwards, matter appeared in the part which received the blow. The phyſician inciſed the part, and ſoon brought it to cicatriſe, as he thought. But a new inflammation appearing afterwards, the part was again inciſed; nor could the wound be now brought to cicatriſation. Galen and ſeveral other phyſicians being called after this, found the os ſternum carious: and though all of them were unwilling to undertake the cure, Galen extirpated the foul part of the ſternum; and found the ſubjacent pericardium in part putrefied, ſo that he could ſee the heart naked; and yet the lad was cured in not a long ſpace of time. This ſeems to be the caſe alſo which Galen mentions in the beginning of his firſt book concerning the Sentences or Opinions of Hippocrates and Plato, (the four firſt chapters of which book treat on the Trunk only), where he ſays that he ſaw the heart in a lad, as plainly as when it is deſignedly expoſed by the diſſection of animals; and adds, that this lad was afterwards cured[b]. But above all, theſe bad conſequences are moſt to be feared, when the external diſcharge of the matter is impeded either by the diſpoſition of the wound or a perverſe treatment.

§. 299. THEREFORE emplaiſters, compreſſes, and tents, ought not to be uſed in theſe wounds; but on the contrary, they ſhould be treated with ſoft deterging balſams, with pledgits of ſoft lint and a ſlack bandage, aſſiſted by a convenient poſture of the body.

Since

[a] De Anatom. Adminſtr. lib. vii. cap. 13. Charter. Tom. IV. p. 161. [b] Galen. de Hippoc. & Platon. Placit. lib. i. cap. 5. Charter. Tom. V. p. 78.

Since therefore ſo many and ſo great evils may ariſe from wounds in the thorax, by the retention of humours extravaſated into the cavity of the wound, where they frequently make new paſſages through the cellular membrane; it is evident, that a free diſcharge ought to be procured for the matter with the utmoſt induſtry. But it is a common practice with ſurgeons in moſt wounds, and eſpecially in thoſe of the thorax, to introduce tents for preventing the upper orifice of the wound from healing before its bottom, and to make way for the diſcharge of foreign bodies contained in its cavity, and alſo to facilitate the application of medicines down to the fundus of the wound. But the very ſkilful ſurgeon Belloſte (to whom we owe the happy contrivance of perforating bones with ſmall foramina to regenerate their perioſteum, as we obſerved in §. 252, 262.) was bold enough to oppoſe the torrent of this practice; and has by ſolid arguments demonſtrated the pernicious effects of tents in wounds, and eſpecially in thoſe of the thorax [a]; and likewiſe ſhown, by many inſtances, that practice confirms what reaſon had thus dictated. For tents, formed of ſcraped lint contorted, or other of the like ſubſtances, being inſerted into the mouth of the wound, ſwell by abſorbing the extravaſated humours, inſomuch that they will thus ſoon thruſt themſelves out of the wound if they are not reſtrained by a plaiſter or bandage: but if they are confined from being thus diſcharged, they ſwell and dilate the orifice of the wound by a ſlow laceration of its fibres and veſſels, not without extreme pain and irritation to the parts; and while they ſtop the orifice of the wound, they hinder the diſcharge of matter or other humours extravaſated, which will be therefore forced to make themſelves new paſſages, and may by that means convert the wound into a ſinous ulcer of a bad condition; or elſe, after eroding the pleura, they may enter the cavity of the thorax, and produce irremediable miſchief. Add to this, that the capacity of the thorax is continually changing every moment of life, and the ribs with their connexed muſcles are perpetually in motion even in the

[a] Chirurgien d'Hopital, p. 1,——43.

the moſt gentle reſpiration: hence ſuch a wound would never be at reſt, but undergo a continual attrition againſt the ſides of theſe tents; from whence would follow pain, inflammation, and at length a callofity in the lips of the wound, which behoved to be afterwards removed before the wound could be healed. From all which it is ſufficiently evident, that no good can be expected from the uſe of tents in wounds of the thorax. And though they may be in ſome meaſure ſerviceable in dilating the mouth of a wound too much contracted, yet that may be better and more eaſily performed by the knife, as we ſaid in §. 238: or if a tent is required to be uſed for this purpoſe, the application of it for a day or two may be ſufficient, ſince the uſe of tents is not here requiſite during the whole time of the cure. A tent of ſponge rightly prepared, (as we directed under the afore-cited aphoriſms), being introduced into the orifice of the wound, will make a conſiderable dilatation of it even in a few hours. For the ſame reaſon it is alſo evident, why the uſe of tenacious emplaiſters is here pernicious; namely, becauſe they impede the free diſcharge of humours from the wounds. The beſt dreſſings, therefore, for wounds of the thorax, are flat pledgits of lint, ſpread with ſome vulnerary balſam or ſoft digeſtives, according to particular circumſtances: over theſe apply a plaiſter not too tenacious, but perforated with ſeveral ſmall holes; retaining them with a convenient bandage, when neceſſary; being yet cautious not to compreſs the mouth of the wound by the compreſſes or bandage, ſo as to hinder the diſcharge of the extravaſated humours.

Hippocrates obſerves, *That whoever, having a wound in the thorax, has the external part of the wound healed before the internal, is in danger of a ſuppuration or abſceſs internally. And in thoſe who have a weak cicatrix formed inwardly, it may be eaſily broken open* [b]. Hence it is evident, that the greateſt caution ought to be uſed to procure a conſolidation of the internal parts of the wound, before

b Quicumque thoracem vulnerati externa parte vulneris ſanati ſunt, interna non, periclitantur, ne ſuppurati fiant. Quibus autem debilis intus facta fuerit cicatrix, facile diſrumpitur. *In Coacis Prænot.* nº 430.

before the external orifice is closed. This may perhaps seem to be an argument in favour of the use of tents, for preventing a concretion of the external lips in wounds: but if it is considered that the tent occludes the mouth of the wound in such a manner that the matter cannot be discharged, it will rather appear to hinder the consolidation internally; since the matter confined in the wound will prevent the contact of the parts necessary to their union, and being accumulated will form new passages betwixt the muscles, and by that means increase the wound internally. But that it is contrary to the opinion of Hippocrates to stop up the mouth of such a wound with tents, may appear from another remarkable passage in the same author, which may serve to explain the passage last cited from his *Prænotiones Coacæ*. For he says, (using the same word ἐμπυοι as in the last passage, and which is frequently used for an empyema, or collection of matter in the cavity of the thorax), *Whoever, being wounded internally, either by a dart, spear, or dagger, has a congestion of matter from the wound, that matter, and indeed any other foreign substance, will be easily discharged, so long as the ulcer has a communication externally by the old wound; which matter is drawn in by cold, and discharged by heat. If now the internal and external parts consolidate at the same time, the wound will be perfectly healed; but if the external parts unite without the internal, a congestion of matter will be formed. But even when the internal and external parts unite at the same time, if the cicatrix internally is weak, rough, and livid, the ulcer will sometimes return, and a congestion of matter be thence formed again*[c].

From which passage it is sufficiently evident, that the cure ought not to be attempted by the use of tents, to

[c] Quicumque a vulneribus purulenti fiunt sive hasta, vel pugione, vel jaculo intus vulnerati sunt, quandiu quidem ulcus foras respirationem habeat per antiquum vulnus, et hæc frigidum in se attrahat, calidum vero a se emittat, tum pus facile, tum sane si quid aliud expurgatur. Et si quidem interna et externa pars simul sanescant, omnino sanus evadit. Sin vere externa quidem pars sanescat, interna vero non, purulentus (ἐμπυος) fit. At vero si simul tum interna tum externa pars sanatæ sint, cicatrix autem intus debilis aspera et livida existat, quandoque reficiatur ulcus, et ab hoc purulentus evadit. *Hippoc. de Morbis, lib.* i. *cap.* 9. *Charter. Tom. VII. p.* 542.

to procure an equal conſolidation of the parts both internally and externally. But the poſture of the body ought to be ſuch, that the humours contained in the cavity of the wound may by their own weight ſubſide to the external opening: and when the bottom of the wound is lower than its orifice, and this cannot be remedied by a convenient poſture in the patient, compreſſes ought to be applied to the bottom of the wound, and a proper bandage uſed to force the contained humours to the opening; and thus the parts will readily unite internally at the bottom of the wound when they are brought into contact by expelling the confined humours. In the mean time, the matter diſcharged by the external orifice will eaſily prevent that from uniting before the internal parts are healed. But if the internal ſurface of the wound, being foul, requires to be cleanſed before it can be expected to heal; then may be applied thoſe remedies which we enumerated in §. 207, and of which we ſhall alſo ſpeak hereafter in the cure of fiſtulæ. The uſe of theſe remedies ought to be continued till the wound affords a white, ſmooth, viſcid, uniform, inodorous and taſteleſs matter; and then a conſolidation of the wound, now cleanſed, may be attempted by an approximation of the ſides by a gentle compreſſure, carried gradually from the bottom of the wound towards its orifice.

§. 300. THAT the wound *has* penetrated into the cavity of the thorax, we diſcover, 1. By conſidering the cauſe and magnitude of the wound. 2. By ſearching with a probe, when the body is placed in the poſture in which it received the wound. 3. By the patient's drawing the air forcibly into his lungs while the wound is cloſed, and then, with his mouth and noſe ſhut, making the ſame effort as in exſpiration; when, the mouth of the wound being ſuddenly let free, the air will ruſh forth, and often form a ſound or noiſe by its agitation in the cavity of the thorax. 4. By

4. By inſpection. 5. By an emphyſema; when the air contained in the cavity of the thorax, being continually augmented by the action of the wounded lungs, rarefied, compreſſed by inſpiration, and its free eſcape through the wound prevented by inſinuating betwixt the lips of the wound, forces its way into the cellular membrane, where increaſing, it often cauſes a ſoft pellucid tumour throughout the whole body, (excepting the ſoles of the feet, and palms of the hands), in ſome places to the thickneſs of eleven inches. See the Hiſtory of the Royal Academy of Sciences for the year 1713. p. 15, 18. alſo 4, 14. and 119, 120. where an account is given of a fatal emphyſema from a fracture of the ribs without a wound of the ſkin. 6. From the diſcharge of frothy blood.

Great caution is neceſſary in determining whether or not the wound penetrates into the cavity of the thorax; for this cavity aſcends higher before, than behind, where it deſcends lower: from whence groſs errors have been ſometimes committed, in thinking a wound penetrated the thorax, when it in reality entered the cavity of the abdomen. Thus we read in Ruyſch[a], of an ignorant ſurgeon dwelling in ſome part without the city, who, being deſirous to perform the paracenteſis of the thorax, ſent for him into conſultation; but Ruyſch being indiſpoſed and unable to come, the ſurgeon by himſelf perforated the thorax, as he thought. Upon which, a large number of hydatides forced themſelves out thro' the wound; and the ſurgeon being affrighted, ſtopped the wound with a tent, and had recourſe to Ruyſch; but to no purpoſe, for the unhappy woman died ſoon after. Upon opening the body, nothing of water appeared in the thorax; but the ignorant ſurgeon, in perforating the abdomen inſtead of the thorax, had wounded the liver, which in that part adhered to the peri-

[a] Obſervat. Anatom. Chirurg. Centur. obſ. 65.

peritonæum, and ſeemed to have degenerated into hydatides, which burſt forth through the wound. From hence may be judged how neceſſary it is to be thoroughly acquainted by anatomy with the true ſituation and connection of the diaphragm, in order to determine any thing with certainty in theſe wounds.

But wounds inflicted in the cavity of the abdomen may paſs into that of the thorax, by perforating the diaphragm: for diſcovering which there are no certain ſigns, ſo that it is ſeldom known but by opening the body after death; and of this we related ſome inſtances in the comment on §. 170. n° 4. But wounds properly ſaid to perforate the cavity of the thorax, of which we are now treating, are diſcovered by the following ſigns.

1. Since almoſt all inſtruments which wound with a ſharp point are of a conical figure; it is evident, that the width of the wound, compared with the wounding inſtrument, may indicate how far the inſtrument has penetrated: but then this ſign may deceive one, when the wound runs obliquely over the ribs among the muſcles; for in that caſe the wounding inſtrument may enter to a conſiderable length, without penetrating the cavity of the thorax.

2. Of this we treated in §. 168, n° 1. and §. 297. where it appeared, that, by changing the poſture of the body from that in which it received the wound, the paſſage of the probe might be eaſily obſtructed by the intruſion of the fat, and by the different poſition of the muſcles.

3. Of this ſign we treated in §. 297. But in performing this, great care is to be taken not to let any air paſs into the cavity of the thorax during the experiment: for by diſtracting the lips of the wound, in dilating the thorax by inſpiration, it may be very poſſible for air to enter its cavity, tho' none had got acceſs before; for in fat people the membrana adipoſa often ſtops up the wound penetrating the thorax, after the inſtrument is extracted, ſo that no admittance is given to the air. Therefore, when this experiment is made, the lips of the wound ought to be firſt carefully compreſſed;

preſſed; and then the patient, after having retained the air forcibly inſpired, ſhould next ſhut his noſe and mouth, and make the effort of exſpiration. Thus the confined air, expanded by heat, will very much dilate the lungs; by which means that lodged betwixt the lungs and pleura will be compreſſed, and likewiſe rarefied at the ſame time by the warmth of the parts: And the wound being now opened, there will be no danger of the external air entering through it into the cavity of the thorax, becauſe the lungs greatly expanded will be applied cloſe to the ſides of the pleura, if no air is as yet contained in the thorax; but if any air has already entered its cavity, it will overcome the preſſure of the atmoſphere, by its rarefaction from the warmth, and compreſſure from the expanſion of the lungs, ſo that it will ruſh out forcibly through the wound. But if the wound was ſuch or ſo large as to admit a very free ingreſs of the air into the cavity of the thorax, and yet not ſo large as much to exceed the aperture of the glottis, (*vide* §. 170, n° 4.) in that caſe the air will enter into and return out of the cavity of the thorax by the wound with a very audible noiſe; and then there is not the leaſt room to doubt of its penetrating.

4. Of this ſign we treated in §. 297.

5. We took notice of this wonderful ſymptom before, in §. 244, ſo far as it ſometimes attends wounds of the head: but it is much more frequently an attendant on wounds of the thorax penetrating its cavity, in which this ſurpriſing kind of tumour may be ſpread in a little time throughout the whole body. For the air having entered into the cavity of the thorax through the wound, whoſe external orifice is at the ſame time cloſed by the fat, ſticking plaiſters, or other dreſſings; this confined and rarefied air often forces itſelf a way into the cellular membrane, or ſpreads through the panniculus adipoſus. But more very large tumours of this kind ariſe more eſpecially when the air-veſſels of the lungs are injured by the wound, ſo as to depoſit their inſpired air into the cavity of the thorax; for in that caſe the malady increaſes every moment. Parey

gives us a wonderful caſe of this kind, which we before related in the comment on §. 249. In this caſe the wind-pipe appeared to be wounded in the neck, and the air eſcaping from the wound inſinuated into the cellular membrane or panniculus adipoſus, and ſo ſupriſingly tumefied the face, that neither eyes nor noſe could be diſcerned. And when the patient was given over by others, a ſkilful ſurgeon, by making deep ſcarifications into the panniculus adipoſus, diſcharged the included flatus, and recovered the patient from the jaws of death[b]. A wonderful emphyſema, following a wound of the thorax that penetrated the ſubſtance of the lungs, is deſcribed in the Memoirs of the Royal Academy of Sciences at Paris[c]. A man thirty years old, of a ſanguine and fleſhy habit, received a wound penetrating the cavity of his thorax, of which he expired on the fifth day. But, before death, his whole body was ſurpriſingly ſwelled with an emphyſema; excepting the ſoles of his feet, palms of his hands, and the vertex of his head. Upon the thorax this tumour was eleven inches thick; upon the abdomen, nine; in the neck, ſix; and in the other parts of the body, four: And the eyes were in a great meaſure thruſt out of their orbits, from the cellular membrane being diſtended with a great quantity of air. There is another extraordinary caſe of this kind mentioned in the ſame book[d], of a fatal emphyſema ariſing from a fracture of the ribs, the ſkin remaining entire. A man ſixty years old had the fourth and fifth of his true ribs, in the left ſide, broken in the middle, by ſome wheels paſſing over his breaſt: ſoon after, a conſiderable ſwelling appeared in the affected ſide, from the entrance of the air into the panniculus adipoſus; which tumour increaſed daily, with a difficulty of reſpiration, till on the fourth day after the accident the man expired. In this body an emphyſema appeared all over its ſurface, excepting the palms of the hands and ſoles of the feet. Upon dividing the ſkin and the reſt of the integuments which covered

b Les Oeuvres d'Ambroiſe Pare, liv. x. chap. 30. p. 249.
c L'an. 1713. p. 5, &c.
d Ibid. p. 154, &c.

vered the broken ribs, a ſmall and ſcarce perceptible aperture was found through the intercoſtal muſcles, without any ecchymoſis; and upon opening the thorax, a ſmall laceration was obſerved in the external membrane which inveſts the lungs, part of the membrane adhering yet to the lungs, and part to the broken rib; but no extravaſated blood was found in the cavity of the thorax.

From hence it is ſufficiently evident, that emphyſematous ſwellings frequently ariſe from wounds in the thorax; eſpecially when the wound admits air into the cavity of the thorax, while at the ſame time it is by any cauſe prevented from eſcaping again through the orifice of the wound. But theſe obſervations teach us, that the very largeſt of theſe emphyſematous tumours will be produced, if the lungs are alſo injured ſo as to tranſmit their air into the cavity of the thorax; eſpecially when there is no conſiderable hæmorrhage at the ſame time, in which caſe the blood filling the cavity of the thorax would prevent the air from being accumulated there in ſo great a quantity as to inflate the cellular membrane of the whole body. Hence the reaſon is alſo evident, why one may juſtly conclude the wound has penetrated the cavity of the breaſt, when one of theſe emphyſematous ſwellings appear ſoon after infliction.

6. This ſign certainly denotes the lungs to be injured: for in that caſe the blood, flowing from the wounded blood-veſſels into the air-veſſels of the lungs, will, by mixing with the air, become frothy; and therefore frothy blood will be coughed up from the wind-pipe, or elſe the ſame blood will run in a ſtream from the external wound. But the lungs cannot be injured, unleſs the wounding inſtrument ſhall have penetrated into the cavity of the thorax; except the lungs ſhould happen to adhere to the pleura in the part wounded, of which we treated in §. 297. Virgil has beautifully expreſſed this circumſtance, where he deſcribes Antiphaten to be wounded by Turnus:

Volat Itala cornus
Aera per tenerum, ſtomachoque infixa ſub altum

Pectus abit: reddit ſpecus atri vulneris undam
Spumantem, et fixo ferrum in pulmone tepeſcit.
ÆNEID. lib. ix. ver. 700, *&c.*

For the ſame reaſon, if frothy blood is ſpit in diſeaſes, it is ſuppoſed to come from the lungs.

§. 301. THE effects or conſequences of ſuch a wound are frequently, 1. A preſſure of the air, which has entered the thorax, upon the ſurface of the lungs, by which means they are indiſpoſed both for reſpiration and for circulating the blood; 2. An extravaſation and accumulation of blood within the cavity of the thorax; 3. A putrefaction of the juices which are extravaſated, heated, agitated, and confined on all ſides; 4. Hence a maceration, eroſion, corruption, and fætor of the pleura, lungs, mediaſtinum, diaphragm, and pericardium; 5. An infinite number of diſorders ariſing from theſe laſt; 6. Spitting of blood.

Here are enumerated the diſorders or accidents which have been ſometimes obſerved to follow wounds penetrating into the cavity of the thorax; all which reſult either from the admiſſion of the air, or the extravaſation of the juices.

1. It was before demonſtrated in the comment on §. 170, n° 4. that naturally there is never any air betwixt the lungs and the pleura in a healthy perſon; and that this was neceſſarily required, in order that the lungs might be diſtended with air ruſhing through the glottis, by the dilatation of the thorax. Whence it follows, that ſo ſoon as the air is admitted, by a wound, into the cavity of the thorax, it will evidently impede the free expanſion of the lungs; or even totally prevent their expanſion, if the wound is large. In the place here cited, we made it evident, from various experiments, how far, and under what reſtrictions, this aſſertion is true. For if the air has a very free paſſage thro' the wound,

wound, the lungs cannot be dilated; but if a ſmaller quantity of air enters through a narrow wound than can enter through the open rima of the glottis, the lungs will then be in ſome meaſure expanded, though not to ſuch a degree as they ought in a ſtate of health. This is very well expreſſed by Galen: *It is a thing well known, that the inſpiration made by the mouth of an animal muſt neceſſarily be diminiſhed by a wound, in proportion to the quantity of ambient air that flows into the cavity of the thorax. But of neceſſity leſs air muſt be exſpired, in proportion as leſs was inſpired by the mouth; and as much as the exſpiration is leſſened, ſo much muſt the voice become ſhorter by a neceſſary conſequence* [a]. If now the air which has entered the cavity of the thorax is from any cauſe confined, or prevented from eſcaping again through the orifice of the wound, it will be rarefied or expanded by the heat; and, by ſtrongly compreſſing the lungs, will obſtruct inſpiration, and conſequently hinder that dilatation of the lungs ſo eſſentially requiſite after birth, in order that the blood expelled by the right ventricle may paſs freely through the narrow extremities of the pulmonary artery. But the rationale of all theſe may eaſily be deduced from the known properties of the air, and from thoſe requiſites which were demonſtrated from phyſiology to be neceſſary for the performance of reſpiration, and for the free circulation of the blood through the veſſels of the lungs.

2. If, for example, the intercoſtal arteries were wounded, the extravaſated blood may collect in a conſiderable quantity within the cavity of the thorax: for the adjacent heart drives the blood with a great force into theſe arteries; and the motion of the thorax in reſpiration prevents the injured arteries from reſting and cloſing ſo ſoon as they otherwiſe might. If at the ſame time the blood-veſſels of the lungs are alſo wounded, it is very evident that a large quantity of blood muſt be

[a] Notum vero eſt, inſpiratione per animantis os facta, tantum neceſſario perire ob vulnus, quantum ejus loco extrinſecus influit circumfluiaeris in thoracem. Quanto autem minus inſpiraverit per os ad neceſſitatem, tanto etiam minus efflari; quanto autem efflatio decreverit, tanto vocem ſequi breviorem neceſſe eſt. *De Anatom. Adminiſtrat. lib.* viii. *cap.* 3. *Charter. Tom. IV. p.* 172.

be ſuddenly accumulated; but if the largeſt blood-veſſels paſſing out from the heart are injured, death ſoon follows. Now the blood thus extravaſated, if not diſcharged by the external aperture of the wound, will be collected in the cavity of the thorax, and hinder the free dilatation of the lungs; whence extreme anguiſh, and difficulty of reſpiration.

3. The blood thus extravaſated, confined in a warm and moiſt place, and continually agitated in reſpiration, will very eaſily degenerate, and acquire a corrupt or putrid ſtate; eſpecially when the air has almoſt continually acceſs through the wound, penetrating into the cavity of the thorax; as alſo when the air is admitted into the cavity of the thorax in inſpiration, by a wound in the air-veſſels of the lungs. The obſervations which have been made in ſurgery teach us, that this extravaſated blood will putrefy in a very ſhort ſpace of time. In our commentaries on §. 172, n° 3. where we treated of theſe diſorders, we related the caſe of a ſoldier, who was wounded in the thorax in ſuch a manner, that he diſcharged blood by coughing from the mouth; and the ignorant ſurgeon ſo united the lips of the wound by future, that nothing could diſcharge itſelf. Parey being called in on the next day, immediately cut open the ſuture; and with his finger removed the thrombus of congealed blood which obſtructed the orifice of the wound; and extracted eight ounces of blood from the cavity of the thorax, already fetid and corrupted. In a nobleman, who had received a wound from the thruſt of a ſword penetrating the cavity of the thorax, after the loſs of ſeven or eight pounds of blood, Belloſte [b] extracted ſix or ſeven ounces of blood already half corrupted, upon removing the dreſſings, towards the end of the day in which the wound was received. And Hippocrates tells us [c], That if blood runs from a wound or blood-veſſel into the thorax, it will of neceſſity turn into matter. But it was demonſtrated before, in the commentaries on §. 172, n° 1. where we cited a like paſſage from his aphoriſms, that by this term of *ſuppuration*

[b] Le Chirurgien d'Hopital, p. 93.

[c] De morbis, cap. 2. circa finem. Charter. Tom. VII. p. 533.

ration he underſtands any kind of corruption of the blood whatever; as Galen has obſerved in his explanation of that aphoriſm.

4. The putrefaction ſo ſoon formed in the extravafated blood, will be every moment increaſing; for there is here a very conſiderable heat from the vital viſcera adjacent, whence the blood will be converted into a moſt putrid maſs. The lungs lodging in this corroding and putrid liquor will themſelves be macerated and putrefied; and the like will alſo happen to the pericardium, pleura, *&c.* It appeared in the preceding n°, that the blood extravaſated into the cavity of the thorax may very ſpeedily corrupt; and that it may there acquire the higheſt degree of putrefaction, we are taught by obſervations. In a man who was wounded in the back, ſo that the ſword entered the cavity of the thorax and penetrated the left breaſt, after the moſt malignant and preſſing ſymptoms, the paracenteſis of the thorax was performed; and on the ſixth day after the infliction of the wound a very conſiderable quantity of matter was diſcharged, but ſo fetid that no one could ſtay in the chamber where the patient lay[d]. In another patient, after the third day from the infliction of the wound, which Scultetus dilated, near a pound of blood diſcharged itſelf from the cavity of the thorax; but of ſo hot a nature, that it ſeemed to burn the patient as it ran out more than a flaming candle[e]. It is therefore no wonder that the ſubſtance of the viſcera may be conſumed and eroded by macerating in ſuch a putrefied maſs of humours, and which, as we read in Hildanus[f], has produced the ſame effect on the compact ſubſtance even of the heart itſelf. A countryman employed in carrying of damp hay, received from thence a fatal illneſs: He felt a ſenſe of pain with a kind of oppreſſion at his heart, and complained of a difficulty in breathing; but four days afterwards he returned to his labour. But ſome days more being elapſed, he was taken with a burning fever, aſthma, delirium, watchings, faintings, *&c.* and expired on the eleventh day of

[d] Scultet. Armament. Chirurg. obſ. 43. p. 255. [e] Ibid. obſ. 50. p. 262. [f] Obſervat. Chirurg. cent. 2. obſ. 27. p. 106.

of the diſeaſe. In opening the body, the pericardium was found replete with a foul matter, in which the heart, appearing to be in a manner ſurrounded, was found eroded or diſſolved for a conſiderable ſpace, towards each auricle chiefly; and the lungs appeared to partake of the ſame diſorder.

5. The extravaſated humours may by their compreſſure or putrid and eroding acrimony diſturb or aboliſh all the functions of thoſe viſcera which are placed in the thorax. Hence a dyſpnœa of the worſt kind, violent palpitations of the heart, intolerable anxieties, inflammations, ulcerations, gangrene, *&c.* may follow in theſe parts. But the extravaſated blood putrefying and becoming attenuated by the heat of the parts and by ſtagnation, may be abſorded by the bibulous veins ſeated in the ſurface of theſe parts, and, mixing with the blood, may produce a putrid cachochymy of the worſt kind: from hence follow putrid and acute fevers, tranſlations of the abſorbed putrid matter to other parts of the body, a phthiſis, atrophe, and death, From all which it is juſtly concluded, that an infinite number of the very worſt diſeaſes may ariſe from humours extravaſated within the cavity of the thorax.

6. If blood be ſpit up immediately after the infliction of the wound, it is a ſign that the lungs are hurt, eſpecially if it appears frothy; and therefore in that caſe blood may eſcape into the cavity of the thorax from the wounded veſſels of the lungs, unleſs perhaps the lungs ſhould adhere to the pleura in that part where the wound was received. If blood is ſpit up ſome days after the wound was received, that may proceed from the extravaſated blood being attenuated by heat and reſt, and re-abſorbed by the veſſels of the lungs. In what manner this is done I ſhall not diſpute; but certain it is, that even an empyema has been cured by a purulent ſpitting. In a true pleuriſy, the ſpitting of a yellow matter mixed with ſtreaks of blood often terminates the diſeaſe, as we are aſſured from innumerable practical obſervations. All this proves the poſſibility there is for the extravaſated blood within the cavity of the thorax to cauſe a bloody ſpitting.

§. 302. THE ſigns of blood extavaſated within the cavity of the thorax are, 1. An orthopnœa; or ſuch a difficulty in reſpiration that the patient cannot breathe but in an erect poſture. 2. The patient's lying eaſieſt on his back, it being very uneaſy for him to lie on the wounded ſide, and impoſſible for him to lie on the ſound ſide. 3. The conſequences deſcribed before in (301). 4. A weight or heavineſs on the diaphragm. 5. A fluctuation of the matter. 6. The nature and ſituation of the wound. 7. Great weakneſs, with paleneſs and cold ſweats. 8. A conſtant increaſe of almoſt all the ſymptoms.

After it has evidently appeared that the wound has penetrated the cavity of the thorax, there ariſes another queſtion of great importance, namely, Whether the divided veſſels have extravaſated any conſiderable quantity of blood within that cavity? And this cannot always be eaſily determined, ſince many of the ſigns which we ſhall hereafter enumerate may prove fallacious; and therefore the concurrence of ſeveral of theſe ſigns is required in order to determine any thing with certainty in this matter. But it may be evidently of the worſt conſequence for a phyſician or ſurgeon to be miſtaken in his diagnoſis here, ſince the extravaſated blood ought to be diſcharged either by the wound or by making a new apertion: but if the thorax be thus perforated while no blood is confined in its cavity, it will admit the air, which is always pernicious here, and the wound will be therefore irritated, *&c.* whence it follows, that one ought to attend to every circumſtance with the greateſt caution, leſt the patient ſhould ſuffer by an operation without neceſſity, or the ſurgeon be injured in his reputation.

1. An orthopnœa is ſaid to be a ſhort, difficult, and noiſy reſpiration, which the patient can perform only with his neck and breaſt erect; and which always denotes, that from ſome cauſe the free expanſion of the lungs

lungs by the inſpired air is impeded. But ſince the blood extravaſated within the cavity of the thorax occupies the ſpace that the dilated lungs ought to fill, it is very evident that this may cauſe a difficult reſpiration. But while the patient holds his body in an erect poſture, the extravaſated blood preſſing by its weight on the diaphragm will augment the cavity of the thorax, by which means the lungs may then receive a ſomewhat farther expanſion, or at leaſt they may be dilated more in that poſture of the body than in any other. Yet if this ſign be attended to alone, it may deceive one: for the air, which entered the cavity of the thorax by the wound, may impede the free expanſion of the lungs, and cauſe an orthopnœa. A ſpaſmodic conſtriction of the lungs in aſthmatic people produces the like diſorder; ſo that if the patient wounded ſhould have been ſubject to an aſthma, this will be no very certain ſign.

2. This is a ſign of very great moment. For the diaphragm deſcending or being continued lower on the back part of the body, much increaſes the capacity of the thorax; ſo that the blood extravaſated within the capacity of the thorax will naturally ſubſide to the lower and back part of it, when the patient lies down; and the back part of the diaphragm will deſcend more eaſily: for the middle of it, to which the broad baſis of the pericardium is attached, is tendinous, and therefore cannot eaſily be depreſſed, as we ſaid before in the commentary on §. 170, n° 4. From all which it is evident, that the extravaſated blood will be lodged eaſier in this poſture than in any other. But when the patient lies on the affected ſide, the poſture of the body will be more painful, though tolerable: Or if he lies on the ſound ſide, the weight of the extravaſated blood will preſs the mediaſtinum and pericardium towards the other ſide of the thorax, whence its capacity will be diminiſhed, and the difficulty in reſpiration increaſed; which the patient in this poſture no ſooner perceives, but he immediately changes it, or turns himſelf, even againſt his inclination, to avoid ſuffocation.

3. Theſe conſequences reſult chiefly from the putrefaction of the extravaſated blood, and the morbid impreſſion

preſſion which is made on the viſcera by ſuch a putrid maſs: ſo that from theſe we may indeed diſcover the exiſtence of extravaſated juices, but this frequently too late.

4. While the patient is fixed in an erect poſture, the whole weight of the extravaſated blood preſſes the diaphragm downwards: therefore at that time the patient perceives the ſenſe of an incumbent weight, with a pain about thoſe parts to which the diaphragm is connected. Frequently alſo a tumour appears in that ſide of the abdomen where the diaphragm is depreſſed; inſomuch that ſometimes, in an empyema, the diaphragm is ſo much depreſſed, and the parts are gradually ſo diſtended by the quantity of the confined matter, as to cauſe the abdomen to protuberate in the manner of an aſcites.

5. Where there is any ſuſpicion of confined matter within the cavity of the thorax, Hippocrates [a] orders the patient to be ſeated in a fixed chair, after the plentiful uſe of warm bathing; and while ſomebody holds his hands, the phyſician muſt endeavour to diſcern on which ſide the noiſe or fluctuation is made while the ſhoulder is ſhook. And the ſame method he takes to diſcover a latent dropſy in the cavity of the thorax [b]; and to determine the place, by opening which the ſerum collected in the thorax may be diſcharged. But it is apparent, that this ſign may ſometimes deceive one: for while the extravaſated blood is collecting in the cavity of the thorax, it congeals by ſtagnating, and therefore renders its fluctuation very difficult to be perceived; alſo, if the thorax is filled with a large quantity of blood, no ſound or noiſe will be heard upon ſhaking the body, by reaſon of the fulneſs: and therefore it is a prudent admonition of Hippocrates, when he ſays, *In thoſe empyemas, where a great fluctuation is heard upon ſhaking the patient's ſhoulders, there is leſs matter, than where the ſound is weak in thoſe who breathe more difficultly and are better coloured.*

[a] De morbis, lib. ii. cap. 10. Charter. Tom. VII. p. 568.
[b] Ibid. cap. 24. p. 576. et De Internis Affectionibus, cap. 24. Ibid. p. 656.

But in thoſe who have no fluctuation, and yet have a very difficult reſpiration and livid nails, the cavity is full of matter, and the patients are in a deplorable ſtate [c].

6. For when we know the ſeat of the wound, and the courſe of the wounding inſtrument through the parts, we can then tell from anatomy whether or not any large artery or vein is injured. Thus the larger trunks of the intercoſtal arteries run near the lower margin of the ribs; thoſe of the internal mamillary are placed near each ſide of the ſternum, at about the diſtance of a finger's breadth from that bone, behind the cartilages of the ribs; the large vena azygos is ſeated on the right ſide of the vertebræ of the back, *&c.*: From a thorough knowledge of all which, the wound is concluded to be more or leſs dangerous.

7. There are ſome men ſo puſillanimous, that they will fall into a deliquium at the ſight of the wounds of others; and in ſuch, when wounded themſelves, though but very ſlightly, all theſe ſymptoms may happen. But in ſuch a caſe they eaſily recover, by the aſperſion of cold water, or the exhibition of a ſtimulating cardiac; nor does the weakneſs which thence ariſes continue long. But when, after the infliction of a wound penetrating the cavity of the thorax, there directly follows great weakneſs, a contraction and paleneſs of the face, a languid pale look of the eyes, a cold ſweat gathering in drops upon the ſkin, eſpecially upon the face and breaſt, and the pulſe is found ſcarce diſcernible; we then know, that, by the wound of the veſſels, ſo large a quantity of blood is extravaſated, that ſcarce any returns to the heart; but that the whole maſs is either diſcharged from the wound externally, or elſe collected within the cavity of the thorax. In ſuch a caſe therefore the moſt imminent danger ought to be declared to be at hand; for they ſuddenly expire. This has been well obſerved by Hippocrates, where he ſays,

[c] Quibus ſuppuratis, dum concutiuntur humeri, multus ſtrepitus fit, minus puris habent, quam quibus, difficilius ſpirantibus et melius coloratis, exiguus. Quibus autem ſtrepitus nullus fit, valida tamen ſpirandi difficultas adeſt, et ungues lividi, pleni ſunt pure, et pernicioſe habent. *In Coacis Prænot.* n° 432. *Charter. Tom. VIII. p.* 877.

ſays, *That wounds which have an hæmorrhage, attended with ſweats, are malignant; for ſuch patients expire inſenſibly while they are ſpeaking* [d]. In his [e] *Prænotiones Coacæ* there is alſo the ſame ſentence; only we there read, εφιδρωσις for επιρριγωσις, *rigors* inſtead of *ſweats*: but he elſewhere obſerves [f], that rigors follow large hæmorrhages, and that the rigor ſtops the flux of the blood; but then it is evident from what went before, that in this place he ſpeaks of a bleeding at the noſe. But when large veſſels near the heart have been penetrated by a wound in the thorax, it is very evident that a rigor may here follow a large hæmorrhage, without producing any ſtoppage of the flux of blood.

8. The blood-veſſels here are very large, and very near the heart: and therefore the blood continues to flow from them into the cavity of the thorax, whence a preſſure upon the lungs, anxieties, difficulty of breathing, &c.; which increaſe every moment, till the hæmorrhage ceaſes, either from a contraction of the divided veſſels, or from a weakening of the patient's vital forces. Many ſymptoms may alſo follow in the patient thus wounded, from the attendant paſſions of anger, or the like; which ſoon gradually vaniſh: but thoſe ſymptoms which reſult from the hæmorrhage, continue as that continues; and therefore a continual increaſe of the ſymptoms is always juſtly reckoned among the ſigns by which we know that blood is extravaſated within the cavity of the thorax. But when a wound penetrates any of the larger cavities of the body, and the ſigns denote that there is room to fear that the divided veſſels extravaſate their blood in full ſtream inwardly, tho' no hæmorrhage appears externally; in ſuch a caſe the prognoſis ought to be made with caution, leſt the reputation of the phyſician or ſurgeon ſhould be riſked if they pronounced no danger: for frequently the patient thus wounded expires unexpectedly, and his death is im-

[d] Sanguinem profundentia cum ſudatiunculis vulnera maligna. Tales enim loquentes occulte pereunt. *Prorrhet. lib.* i. nº 130. *Charter. Tom. VIII. p.* 791.

[e] Nº 328. Charter. ibid. p. 870. [f] Prorrhet. lib. i. nº 152. Charter. ibid. p. 799.

puted to their ignorance, by thoſe who plead the cauſe of the wounder. But how carefully one ought to attend to all the appearances, in order to determine rightly whether or not any extravaſated blood is lodged in the thorax, is evident, inaſmuch as the moſt ſkilful are ſometimes deceived herein. The celebrated M. Mery[g] ingenuouſly confeſſes, that in a young man who was wounded with a ſword in the anterior and upper part of his right arm, within three hours after the wound was inflicted he obſerved ſo many and ſo great ſymptoms, that he made no doubt but that the cavity of the thorax was full of extravaſated blood, and therefore began ſeriouſly to think of making the paracenteſis. But the event afterwards taught that the caſe was otherwiſe, the patient being perfectly cured of his wound within the ſpace of eight days. It ſeemed highly probable, however, that the tendon of the pectoral muſcle being injured, occaſioned the ſevere pain of the breaſt, great difficulty of reſpiration, *&c.*

§. 303. THE extravaſated blood ought to be immediately extracted, 1. By a convenient poſture, motion, and ſtraining of the body: 2. By ſucking through a flexible tube, having holes in its ſides, and being obtuſe at the end: 3. By injecting ſome diluent, attenuating, and deterging liquor: 4. By dilating the wound: or, 5. By making another opening betwixt the ſecond and third of the lower true ribs, at the diſtance of four fingers breadth from the vertebræ, and as much from the lower angle of the ſcapula; making your inciſion with a knife, parallel to the ribs, betwixt the middle of them, and directing the edge downwards.

After it has appeared, from the ſigns enumerated in the preceding paragraph, that extravaſated blood is lodged in the thorax, the curative indication then directs

[g] Academ. des Sciences, l'an 1713. Mem. p. 159.

rects immediately to remove or extract it, leſt it prove prejudicial by its preſſure or putrefaction. At the ſame time, however, it ought to be particularly remarked, that this extravaſated blood ſhould not be diſcharged before it appears that the wounded veſſels have done bleeding: For of what ſervice can it be to diſcharge the blood, if, by the motion of the body, ſucking, injections, or the like, the wounded veſſels yet open are ſo irritated as to continue bleeding. When the pulſe appears ſufficiently ſtrong and equal, the extreme parts of the body feel warm, no hiccup or convulſion appears, and the patient's ſtrength continues; we then know that the internal hæmorrhage has ceaſed, and that the means required for diſcharging the blood from the cavity of the thorax may be now ſafely uſed.

But it may be doubted whether the extravaſated blood ought always to be diſcharged by art, ſince it is apparent from the moſt faithful obſervations, that blood, matter, water, *&c.* has gradually vaniſhed from the cavity of the thorax, and, being abſorbed by the veins, has been afterwards diſcharged by ſweat, urine, *&c.* Such a caſe is related by *Fabricius ab Aquapendente* [a]. A friend of his received a wound in the thorax penetrating into its cavity; but ſo ſmall, that it could not be diſcovered, even by the probe, that it had penetrated: which yet appeared from the ſpitting of blood, the ſenſe of a weight preſſing on the diaphragm, a cough, fever, obſtructed reſpiration, *&c.* But ſince nothing could be extracted by the wound, the phyſicians concluded to make the paracenteſis of the thorax on the day following. In the mean time it happened, that the patient diſcharged a pot-full of blood by urine; which relieved him from the pain, fever, and all the other ſymptoms. Another caſe of the ſame nature is to be found in Belloſte. [b]. A captain received a wound penetrating the cavity of the thorax, and entering the lungs; and all the ſymptoms appeared which uſually attend ſuch wounds. When a vein was opened; inſtead of blood, real matter was diſcharged, to the re-

[a] Opera Chirurg. Part. I. lib. ii. cap. 22. p. 214. [b] Chirurgien d'Hopital, p. 265.

lief of all the bad ſymptoms. Our author teſtifies, that this caſe was told him by a very expert ſurgeon, and confirmed to him by ſeveral eye-witneſſes of inconteſtible credit. A copious diſcharge by urine, or a plentiful ſweat, has been often obſerved of ſervice in ſimilar caſes, by the ſame author [c]: And there are many more of the like obſervations to be met with; but theſe are ſufficient to prove, that nature, who on ſo many occaſions aſſiſts herſelf, ſometimes cures ſuch wounds by extraordinary ways. But this does but rarely happen; and it is the part of a prudent phyſician to attend diligently whether the ſigns denote that nature is about to make ſuch an attempt: but in the mean time, if we were to truſt to nature only in theſe caſes, it is certain that many would periſh, from a deſtruction of the vital viſcera by the extravaſated and putrid blood, who by an artificial extraction of the ſame blood might have been ſaved. This extraction therefore is to be attempted by the following means.

1. If the blood lodged in the cavity of the thorax is as yet fluid, and the wound being ſufficiently large does not run obliquely thro' the integuments, but directly penetrates into the cavity; in this caſe, if the patient be placed in a convenient poſture, the blood may deſcend by its own weight to the mouth of the wound, and diſcharge itſelf without other aſſiſtance. Therefore in ſuch a caſe the moſt ſkilful ſurgeons apply nothing to the orifice of the wound for ſome hours, that the blood may have a free exit. Thus Dionis [d] treated a man wounded into the thorax under the right breaſt: For when he found the cavity of the thorax full of blood, he firſt dilated the orifice of the wound, and then ordered the patient to lie all night on the wound; ſo that on the next morning he found the cavity of the thorax quite void of any blood, and the patient was happily cured. Parey [e] ordered a man, who was wounded in the ſame manner, to be placed with his feet upwards, and his head downwards; and then introducing his fingers into the orifice of the wound, he removed the

[c] Ibid. p. 94, 95. [d] Operations de Chirurg. p. 295, 296.
[e] Liv. x. chap. 32. p. 251.

the thrombus of congealed blood, extracted that which was extravaſated, and delivered the patient from imminent danger of ſuffocation.

This method of diſcharging the extravaſated blood from the mouth of the wound, is facilitated by a compreſſure of the abdomen, either by the hands or by a broad roller, the patient at the ſame time retaining the inſpired air as long as poſſible, and then making the effort of exſpiration while the glottis is cloſed; for thus the lungs being extremely dilated, and the diaphragm preſſed upwards, the blood extravaſated into the cavity of the thorax will be preſſed out through the mouth of the wound.

2. Since it is often very inconvenient, in many wounds of the thorax, to keep the patient in ſuch a poſture, as that the extravaſated blood may diſcharge itſelf by its own weight through the opening of the wound; therefore another method has been contrived, namely, the introduction of a [f] flexible pipe, of gold, perforated in the ſides with many apertures, and furniſhed with a golden probe filling its cavity (which is to fit it for bending without diminiſhing or ſpoiling its cavity), which is to be carefully paſſed through the mouth of the wound, as low as poſſible into the cavity of the thorax; and then by ſucking, or by the application of a ſyringe, they extract the extravaſated blood. The apex or end of this tube is required to be obtuſe, to prevent it from hurting the lungs. A tube of the ſame form, and for the ſame uſe, may be made of lead; as alſo of flexible leather and whale-bone. By introducing ſuch an inſtrument inflected like a ſiphon or crane, and then drawing out the probe, [g] Scultetus extracted a large quantity of extravaſated blood from the cavity of the thorax, with out making any ſuction.

3. It is apparent, that the two preceding methods take place only when the extravaſated blood is fluid; for if it has concreted into grumes, it will not eaſily eſcape through the mouth of the wound, much leſs will

[f] Scultet. Armament. Chirurg. tab. xii. fig. 9 & 10. [g] Ibid. obſ. 42. p. 248.

will it enter the ſmall orifices of the introduced tube. It is indeed true, that congealed blood ſpontaneouſly diſſolves itſelf in time: but then it alſo putrefies, which is here very prejudicial to the patient; and frequently the anguiſh from the compreſſion of the lungs is ſo great, that one cannot poſſibly wait for this ſpontaneous diſſolution. In this caſe therefore we inject into the cavity of the thorax warm water, with the addition of ſome honey, Venice ſoap, and a little ſalt, (as we directed in the comment on §. 236.); this liquor being afterwards agitated by the motion of reſpiration, is in a manner blended with the concreted grumes, which are by this means diſſolved, ſo as to be capable of paſſing out with the injected liquor through the mouth of the wound. The injection is to be rendered medicinal, with different ingredients, according as different circumſtances may require. For diluting and diſſolving the concreted blood, warm water will be ſufficient, mixed with a little honey and ſalt; but when the extravaſated blood has already began to putrefy, it will be convenient to uſe an infuſion of ſcordium, rue, horehound, and the like gentle deterging and antiſeptic ingredients.

4. Of this we treated before §. 238.

5. When the wound is of ſuch a nature, that it is impoſſible to diſcharge through it the liquors contained in the thorax, there is then no method left but to make a new opening in a part of the thorax to which, from the internal figure of its cavity, the confined juices have a natural tendency. This method is more eſpecially neceſſary when the wound is inflicted in the upper part of the thorax; for then it is ſcarce poſſible for the extravaſated blood to paſs out through the orifice of the wound. But ſince the cavity of the thorax deſcends deepeſt towards the back, from the inclined poſture of the diaphragm, therefore the thorax is to be perforated in its back-part, as low as can poſſibly be done without danger of injuring the diaphragm, which is attached to the lower ribs, and, by aſcending forwards from the poſterior part of the thorax, forms with the bodies of the vertebræ a pretty acute angle. But

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in order to avoid injuring the ſtrong muſcles termed *ſacrolumbalis*, *longiſſimus dorſi*, *&c.* which aſcend thro' the loins and back on each ſide the *ſpina dorſi*, the opening ought to be made at the diſtance of four fingers breadth at leaſt from the vertebræ. The opening is moſt uſually made betwixt the ſecond and third, or betwixt the third and fourth, of the ſpurious ribs, reckoning from below upwards. But ſince it appears from anatomy [h], that the diaphragm aſcends higher in the right ſide of the thorax, therefore when the paracenteſis of the thorax is made on that ſide, it is uſually performed betwixt the third and fourth rib; but, when on the left ſide, betwixt the ſecond and third of the ſpurious ribs, as Van Solingen [i] has obſerved. Perhaps it is for this reaſon that Hippocrates [k], inquiring which ſide of the thorax ought to be perforated in an empyema, wiſhed the matter to be lodged in the left ſide. Dionis [l] alſo directs to make the opening betwixt the third and fourth rib. Hence an error ſeems to have crept into the text of this aphoriſm, when it directs the place for inciſion to be between the ſecond and third of the true ribs, ſince in a paſſage that follows afterwards the place is directed to be much lower; and in §. 1191, n° 3. treating of the paracenteſis of the thorax in the cure of an empyema, the place is directed to be betwixt the fourth and fifth, or fifth and ſixth ribs, counting upwards; which is the place that [m] Ægineta obſerves to have been perforated by ſome in the cure of an empyema, though he preſages either ſudden death or an incurable fiſtula from the operation. I therefore believe that the text ought to be read, *betwixt the ſecond and third of the lower ſpurious ribs:* unleſs we ſhould here underſtand the perforation to be made in the anterior part of the thorax, which may then be certainly beſt made betwixt the ſecond and third of the true ribs, counting upwards, as [n] Dionis directs; who only

[h] B. Siegfr. Albini Hiſtor. Muſculorum Hominis, lib. iii. cap. 81, p. 300. [i] Manuale Operatien, *&c.* tweede deel, cap. 1. p. 118. [k] De Morbis, lib. ii. cap. 16. Charter. Tom VII. p. 568. [l] Dionis Cours d'Operations de Chirurgie, Demonſtrat. 5. p. 296. [m] Lib. vi. cap. 44. [n] Cours d'Operations de Chirurgie, &c. p. 296.

mentions only one advantage from making the paracenteſis in this part, namely, that the patient can dreſs his own wound in the abſence of the ſurgeon. But the greater profundity of the thorax backwards, and the natural tendency of the blood towards a low aperture when the patient is in a ſupine poſture, rather perſuade us to prefer the perforation of the thorax in its poſterior and lower part. Hippocrates [o], in treating of the cure of an empyema, though he does not directly point out the place to be inciſed, does yet determine it to be made in the loweſt and back part of the thorax. For he ſays, *If the matter ſhould, from its thickneſs and great quantity, yield no fluctuating noiſe whereby it may be diſcovered, as is ſometimes the caſe; which ever ſide is tumefied and moſt painful, there a perforation ought to be made, rather in the loweſt and moſt backward part of the tumour than more forward, that you may have a more eaſy diſcharge of the matter. But to cut betwixt the ribs*, &c. And again, ſpeaking of the ſame diſeaſe, he ſays, *You ought to make your inciſion, or apply your cauſtic, as near as poſſible to the diaphragm, taking care to avoid that itſelf* [p], i. e. *not to injure it.*

In a dropſy of the thorax, where the water is to be extracted, Hippocrates [q] directs to inciſe down to the bone from the laſt to the third rib, and then to perforate with a ſharp terebra; and after the perforation is made, he orders the water to be extracted by a little at a time, &c. From whence it is ſufficiently evident, that Hippocrates choſe the loweſt part of the thorax, in order to extract the contained humours by perforating it.

The place being thus determined, may be eaſily found by counting the ribs when the patient's body is unclothed: but when the patient is fat, or when an emphyſema attends, this may be more difficult to diſcover; and

[o] At ſi præ craſſitudine et copia (puris) nullum ſtrepitum ediderit, quo illud deprehendatur (fit enim hoc aliquando), utrumlibet latus intumuerit, ac magis doluerit, illud infima parte ſecare (oportet) a poſteriori magis tumoris parte, quam ab anteriori, ut facilis tibi ſit puris effluxus. Secare vero inter coſtas, &c. *De Morbis, lib.* ii. *cap.* 16. *Charter. Tom. VII. p.* 568.

[p] Secare aut urere oportet quam proxime ad ſeptum tranſverſum, cavendo tamen ipſum ſeptum. *Ibid. lib.* iii. *cap. penult. p.* 593.

[q] De Internis Affection. cap. 24. Charter. Tom. VII. p. 656.

and therefore ſurgeons have endeavoured to determine the part for inciſion by another method. They draw a ſtring ſtraight from the enſiform cartilage to the *ſpina dorſi*, and then divide the ſaid ſtring into three equal parts, and then they determine the place to be two thirds of the length of the ſtring diſtant from the ſternum[r]. Dionis[s] meaſures the diſtance of four fingers breadth from the lower angle of the ſcapula, and at the like diſtance from the *ſpina dorſi* he marks the place to be inciſed. But ſince the ſcapula is moveable, and may change its place by the different actions of the muſcles attached to it, it is evident that this method cannot be always very certain. It will be therefore beſt to examine the part thus pointed out by the fingers, to ſee whether it falls upon the interval betwixt the ribs.

When the part to be inciſed is thus known, it is uſually marked with ink, that it may not be loſt again. But as the ribs are moveable, it is very evident, that an alteration in the poſture of the body will alſo change the ſituation of the ſkin. Therefore Hippocrates juſtly cautions, *That when you would either inciſe or cauteriſe, making a mark of diſtinction, cauſe the parts to keep the ſame poſture during the inciſion or cauteriſation, that the figure of the ſkin may not deceive you by its ſhifting upwards or downwards*[t]. The opening ought next to be made with a knife, or ſome cutting inſtrument; not with a pointed one, as in the paracenteſis of the abdomen, which is made by a ſteel bodkin included in a ſilver canula; becauſe there would be great danger of wounding the lungs by puncturing in that manner. But in order for a cutting inſtrument to penetrate into the cavity of the thorax, the ſkin, panniculus adiposus, latiſſimus dorſi, and intercoſtal muſcles, with the pleura, muſt be divided; to perform which with ſafety, the

[r] Van Solingen Manuale Operatien tweede deel, cap. 1. p. 118.
[s] Cours d'Operations de Chirurgie, demonſt. 5. p. 296.
[t] Quum vero ſecare aut urere voles, nota impreſſa, fac ut eandem figuram ſervent inter ſecandum aut urendum, ne fallat cutis figuræ mutatione ſurſum vel deorſum vergens. *De Morbis, lib. iii. cap. penult. Charter. Tom. VII. p. 593.*

the patient ſhould incline his body a little backward to relax the ſkin, that the ſurgeon may elevate all the common integuments together with the latiſſimus dorſi, if poſſible; and that, being thus elevated, he may divide them at one and the ſame time, with a wound ſufficiently large, and of the length of three or four fingers breadth. This done, the patient ſhould incline his body a little forwards, and towards the oppoſite ſide, that the ribs may recede more from each other, and the intercoſtal muſcles be extended: then may the ſurgeon cut through the tenſe intercoſtal muſcles and pleura, with a ſcalpel a little crooked, along the whole back of which the fore-finger is to be applied, and at the ſame time the point of the knife is to be covered with the end of the finger, penetrating carefully into the cavity of the thorax by a ſmall wound, to avoid injuring the lungs: as ſoon as the pleura is divided, the lungs immediately collapſe and recede from the ribs; ſo that then the wound may be ſafely enlarged. But the inciſion is to be made parallel to the ribs, and in the middle ſpace betwixt them; directing the edge of the knife downwards, to avoid the intercoſtal veſſels which lie hard by in a hollow ſulcus or groove in the lower margin of the upper rib.

With theſe precautions, this operation may be very ſafely performed; though there are ſtill a few more admonitions which occur in authors regarding the ſame, but which ſeem to be of leſs moment. Thus *Fabricius ab Aquapendente* [u] will have it, that the patient ought to breathe out the air at the inſtant of making the perforation through the pleura, that, by the receſſion of the lungs from the pleura at that inſtant, they may not be injured by the knife. But at this time of day we know from phyſiology, that the lungs are always contiguous to the pleura, both in exſpiration and inſpiration, and that they follow the dilatation of the thorax. Hippocrates [v] takes notice, that if the matter or water be all of a ſudden diſcharged, either by inciſion or cauſtic, from a patient who has an empyema or dropſy of the

[u] Operat. Chirurg. cap. 45. p. 490, 491. [v] Aphor. 27. ſect. 6. Charter. Tom. IX. p. 263.

the thorax, it kills him; and therefore ſome would not have all the extravaſated blood extracted at once, but at ſeveral times. Now, in an empyema, or in a dropſy of the thorax, the lungs have lain a long time macerating in the matter, or in the extravaſated ſerum flowing all around, ſo that, upon diſcharging the whole maſs at one and the ſame time, the lungs might have their weakened veſſels burſt by the ſudden dilatation of them with blood, whence ſudden death. But when this operation is made in wounds of the thorax it is very rarely that the caſe has been ſo long delayed as to occaſion any danger of this nature; and it appears from many chirurgical obſervations, that all the extravaſated blood has been thus extracted ſuddenly, or at once, with ſafety. What renders this operation the more eaſily practicable, is the compreſſure of the lungs by the extravaſated humours, and the depreſſure of the diaphragm by their weight, by which means thoſe two organs are not eaſily injured upon perforating the pleura.

It was obſerved in §. 297. that the lungs ſometimes adhere to the pleura: now if this ſhould unluckily happen in the place where the paracenteſis is made, it will evidently occaſion no ſmall difficulty. Moſt of the writers in ſurgery who have treated on this operation teſtify, that they have met with this accident; and they then direct the ſurgeon prudently to ſeparate the lungs from their adheſion to the pleura with his finger. At leaſt, nothing more can be done than to make trial of this, though it may ſeem cruel thus to lacerate the adhering parts in a living man; but unleſs this be done, the paracenteſis is made to no purpoſe. There is an extraordinary place in Hippocrates, which ſeems to point at this. For he there deſcribes the ſymptoms which follow when (ο πλευμων προσπεσων ες το πλευρον) *the lungs ſettle to the ribs or ſide;* and which agree much with the appearances which are obſerved when the lungs adhere to the pleura after acute or inflammatory diſeaſes of the thorax, and to this alſo the cure which he propoſes for the diſorder very well agrees. But he afterwards adds, *But if this happens in a wound, or in the paracenteſis for an empyema, you are to introduce a*

bladder faſtened to a pipe, and fill it with wind; and you are afterwards to make a farther ſeparation by a ſolid probe of tin [x]. From which paſſage we may conclude, that in order to ſeparate the lungs from the pleura, Hippocrates introduced a complicated bladder through the wound, which he then inflated, and by the diſtenſion of the flatus within the cavity of the thorax, forced the lungs from the pleura. At leaſt, it ſeems to follow, that this ſeparation of the lungs adhering to the membrane of the pleura was attempted thus early. For fear of this adheſion, ſome adviſe to make a careful inciſion through the intercoſtal muſcles without wounding the pleura; which is then to be diligently examined, to ſee whether any unuſual thickneſs or calloſity of it gives any room to ſuſpect ſuch an adheſion of the lungs to that part; and if ſo, it will be adviſeable to continue the inciſion a little longer, till you come to a part free from this coheſion. But this method of operating is more eaſily ſhewn in a dead body, than is practicable in a living ſubject, where it ſeems very cruel to make ſuch a ſlow and gradual inciſion. And there are alſo ſometimes obſerved ſuch ample adheſions of the lungs to the pleura as may even render this method of operating quite fruitleſs. Thus I obſerved, in the body of a young nobleman, who died ſuddenly of an apoplexy following an hemoptoë, ſuch an adheſion of the middle lobe of the right ſide of the lungs every way to the pleura, as ſeemed to partition the right cavity of the thorax into two very diſtinct cells. If, now, in ſuch a condition of the patient, a wound was inflicted in the upper part of the right ſide of the thorax; it is apparent that the paracenteſis, made in its uſual place, would then be of no manner of ſervice. But this is rarely the caſe: and a difficulty hence ariſing ought not to be aſcribed to any default of the artiſt, but to the art, ſince there are no ſigns by which ſuch an adheſion can be previouſly known.

The

[x] Si vero ex vulnere illud fiat, aut empyico ſecto (fit enim) huic veſicam fiſtulæ alligans, flatu implere, et intus immittere, et penicillum ſtanneum ſolidum imponere, et ulterius repellere (oportet). *De Morbis, lib.* ii. *cap.* 23. *Charter. Tom. VII. p.* 575.

The thorax being thus perforated, all the methods prescribed in the preceding paragraphs may be then put in practice to discharge the extravasated blood. But if liquors are to be injected for dissolving the concreted blood, it will be most convenient to convey them in first by the wound, because of its situation in a higher part of the thorax, and then they may be easily discharged together by the new opening when made.

§. 304. IF these wounds are not distended with any tents, are seldom opened, and secured from the air; that air which was admitted may be expelled by an artificial sucking, and by proper efforts in respiration; and if the cold be also carefully avoided, the cure may be then compleated, when practicable, with ease and in a short time.

We before proposed (in §. 299.) the reasons for which the use of tents ought to be rejected in wounds not penetrating the thorax; and they seem to be no less pernicious in such wounds as do penetrate into the cavity of the thorax. But if they are at any time to be used, it is when the juices confined in the cavity of the thorax are not to be all discharged at once, but at different times; which, though sometimes necessary in an empyema, or in a dropsy of the thorax, according to the admonition of Hippocrates, is very rarely required in wounds of the thorax; but, in the former cases, they are inserted into the wound to admit of a discharge of the juices stagnating in the cavity of the thorax when it shall be thought proper. Even Bellostе [a], who in other cases almost universally condemns the use of tents as pernicious, does yet allow, that they ought to be used for the first days after performing the paracentesis of the thorax, to prevent a concretion of the pleura divided in the recent wound. But afterwards they seem to be always pernicious, since they swell or dilate by absorbing the juices, and rubbing a-

 gainst

[a] Chirurgien d'Hopital, part. iii. chap. 6. p. 228.

gainſt the ſides of the wound by the motion of the thorax, render them callous and more difficult to heal. Some think by the uſe of them to prevent the ingreſs of the air into the cavity of the thorax: but, upon the removing the tent at each dreſſing, the air will have a very free ingreſs by the patulent orifice, and its diſcharge will be afterwards prevented by the intruſion of a new tent; ſo that, dilating by the warmth of the parts, it often makes itſelf ſurpriſing paſſages, and may produce the moſt malignant emphyſemata. It is therefore better to cover the mouth of the wound only with a flat pledgit, and leave a free paſſage for the humours to eſcape by the opening or wound; through which, if large, you ought to be very careful that the pledgit does not ſlip into the thorax, which authors acknowledge to have ſometimes happened in the uſe of tents. A Daniſh nobleman being wounded, and negligently treated by the ſurgeon, the tent ſlipped into the cavity of the thorax, and was ſix months afterwards diſcharged by the mouth; and yet the patient enjoyed a ſtate of health after this [b]. A man was wounded with a ſword, which penetrated into the right cavity of the thorax near the axilla, betwixt the ſecond and third of the true ribs; from which wound blood was diſcharged for the ſpace of fifteen days, and ſome was alſo ſpit up by coughing. After many and very troubleſome ſymptoms, the wound at length was cicatriſed; but a difficulty in breathing ſtill continued, with an inceſſant cough, and a ſpitting of a fetid and greeniſh matter. Three months being elapſed from the cure of the wound, the patient brought up, together with a good deal of matter, a couple of tents, which had ſlipped into the thorax from under the emplaiſter at different times during the cure of the wound [c].

Another thing here required here, is, to exclude the air from entering through the wound into the cavity of the thorax; or to diſcharge it, if it has entered. But it is impoſſible to exclude the air ſo long as the extravaſated humours remain there, ſince they require a free paſſage;

[b] Tulp. Obſerv. Medic. lib. ii. cap. 15. p. 123, 124. [c] Hildani Obſerv. Chirurg. cent. 1. obſ. 46. p. 41.

paſſage; but when nothing more is diſcharged from the wound, then the air lodged in the cavity of the thorax, betwixt the lungs and the pleura, ought to be extracted, and all poſſible care taken to prevent it from entering again. For it appears from phyſiology, that in order to the free expanſion of the lungs by inſpiration, it is neceſſary there ſhould be no air in the cavity of the thorax. Now this diſcharge of the air may be procured either by ſucking; or by the method following, which is the beſt of any. Let the lips of the naked wound be preſſed together by the fingers in ſuch a manner as that no air can enter; and then let the patient draw in a large quantity of air into his lungs by a deep and long inſpiration, and retain this air as long as he well can: now the air thus retained, being rarefied by the heat of the parts, will expand the lungs, and compreſs the air lodged betwixt the lungs and the pleura. If then the lips of the wound are opened or drawn aſunder, a great part of the air confined in the thorax will be expelled; after this the lips of the wound are to be immediately cloſed again, before which the patient muſt not exſpire. By repeating this method ſeveral times the whole quantity of air may be entirely expelled from the cavity of the thorax, and the patient will directly perceive that he can breathe much more commodiouſly. All the air being thus expelled, let a ſticking plaiſter be immediately applied at the inſtant when the patient retains the inſpired air in his lungs; at which time the lungs, being diſtended and contiguous to the pleura, will obſtruct the paſſage of the air about to enter through the wound. This emplaiſter is to be continued upon the parts for a very conſiderable time; and when it is neceſſary to renew the dreſſings, another ſticking plaiſter of the like kind is to be applied with the ſame precautions; and if the ſeldom dreſſing of a wound is ever uſeful, it muſt certainly be ſo in theſe wounds of the thorax. The uſefulneſs of this method is proved by the experiments made on living animals, as deſcribed under §. 170, n° 4. For when each ſide of the thorax was perforated with a large wound, the reſpiration wholly ceaſed, and the animal ſeemed dead; but the

intruded air being by this artifice expelled from the cavity of the thorax, the animal revived, and immediately recovered its voice.

But ſince all the parts contained in the thorax are near the fountain of heat, the heart, and are continually cheriſhed with a gentle warmth, the utmoſt caution is to be uſed to preſerve them from the contact of the unuſual cold; and therefore a warm air is always neceſſary here, when the dreſſings are to be renewed.

By this method wounds of the thorax have been ſometimes cured, even though very dangerous, and attended with the moſt ſevere ſymptoms; and that we ought not eaſily to deſpair in the worſt of them, may appear from the extraordinary obſervations given us, and of which ſeveral were related in §. 170, from authors of the beſt repute. There is doubtleſs at all times reaſon to fear much danger in theſe wounds, ſince the vital viſcera, namely, the heart and lungs, with the largeſt blood-veſſels of the whole body, are here ſeated: but ſince even wounds of the heart itſelf are not always abſolutely mortal, (of which viſcus Pliny ſays, *that it alone, of all the viſcera, does not waſte with diſeaſes; nor does it receive life from any other part; and being wounded, produces inſtant death* [d],) it is evident, that, even in the moſt dangerous wounds, there always remain ſome hopes of a recovery; perſons having ſometimes recovered when they have been left for dead after wounds of the largeſt veſſels, when no manner of care was taken of them, nor any cordials given to ſtrengthen them. It is alſo evident, not only that the moſt dangerous wounds of this kind have been cured, but that the cure has been accompliſhed in a very ſhort time. A captain had the right ſide of his thorax perforated with a ſword near the axilla, and in a very ſhort time loſt ſeven or eight pounds of blood; nor did the hæmorrhage ceaſe, even though the wound was dreſſed up with a ſuitable apparatus; and his pulſe weak and unequal, frequent fainting-fits, a fever, *&c.* afforded no

[d] Quod ſolum hoc viſcerum vitiis non maceratur, nec ſupplicia vitæ trahit, læſumque mortem illico affert. *C. Plinii Secundi Natur. Hiſt. lib.* xi. *cap.* 37.

no good preſage. The day after, the hæmorrhage not yet ceaſing, the patient was obliged to change his place of reſidence, inſomuch that every one believed he would expire in the journey: and yet, the wound being only covered with a plaiſter, the patient was ſo much relieved by a copious diſcharge of urine, a ſpitting of blood, and a profuſe ſweat on the next night, that all the ſymptoms vaniſhed, and the wound was in a ſhort time cured barely with an incarnative emplaiſter; ſo that, on the fifth day after infliction, he could ride a horſe very well, nor did he from that time any longer keep his bed in the day [e]. Many ſuch inſtances are to be found in the ſame author, which teach us, that the moſt violent wounds of the thorax, attended with the worſt ſymptoms, have been happily cured in a very ſhort time without the uſe of tents, and with ſeldom renewing the dreſſing.

§. 305. AND thus all thoſe ſevere ſymptoms which we mentioned (301) will be prevented.

The very worſt ſymptoms which appear after wounds in the thorax, ariſe almoſt entirely from the air admitted into its cavity; or from the extravaſated juices diminiſhing its cavity, or elſe corrupting and injuring the included viſcera. When theſe wounds are not filled with tents, the extravaſated blood has a free exit; and the ſeldom dreſſing, with the precautions before delivered, will prevent the air from entering, and that which has been already admitted may be expelled by the methods before deſcribed. By theſe means the cure always happily ſucceeds, unleſs ſome part be injured, without the integrity of which life cannot ſubſiſt: and it is alſo from hence apparent, that the hiſtory and treatment of wounds in the thorax afford much light into ſeveral other diſorders of the thorax and its contained viſcera; as will afterwards appear, when we treat of the Empyema and Dropſy of the Thorax.

Of

[e] Belloſte Chirurgien d'Hopital, part. ii. chap. 8. p. 92.

Of Wounds in the ABDOMEN.

§. 306. WOUNDS of the abdomen *not* penetrating into its cavity are diſcovered to be ſuch, 1. By the probe, and by their courſe or ſituation; 2. By injection; and, 3. From a knowledge of the nature of the wound, and of the wounding cauſe or inſtrument.

The trunk of the body is divided into two large cavities, of which the upper and leſſer is called the *thorax*, and the lower and larger the *abdomen*. The cavity of the abdomen is divided from that of the thorax by the diaphragm; and therefore all the parts of the trunk below the diaphragm appertain to the abdomen, whether they be parts containing or contained. The whole circumference of the thorax is encompaſſed by the ribs; but the greateſt part of the abdomen is defended only with the ſoft integuments. For if we except the ſuperior and lateral parts of the abdomen on each ſide, which are encompaſſed by the ſpurious ribs, behind which the large liver and ſpleen are ſafely placed, as being the moſt friable or tender of the abdominal viſcera; to which if we add the column of vertebræ occupying part of the abdomen behind; and, laſtly, the inferior and lateral parts, which are defended by the oſſa innominata on each ſide; excepting theſe, all the other parts of the abdomen are ſoft. As the cavity of the thorax is inveſted on all ſides with a membrane called the *pleura*; ſo the cavity of the abdomen is alſo every way lined with a ſimilar membrane, named the *peritonæum*. And from hence it is, that wounds of the abdomen are in general diſtinguiſhable like thoſe of the thorax: for all wounds injuring the containing parts of the abdomen without dividing the peritonæum, are called *not penetrating*; as thoſe which do perforate the peritonæum are ſaid to penetrate into the cavity of the abdomen. But whether or not a wound has thus penetrated, is diſcovered by the following ſigns.

1. Of this we treated in the commentaries on §. 300, n°

nº 2. but in the abdomen the difficulty is ſtill greater, eſpecially in corpulent habits, where that part of the trunk is covered with a vaſt quantity of fat. From hence it is, that the moſt ſkilful ſurgeons have affirmed, that nothing certain can be diſcovered in theſe wounds by ſearching with the probe: for a change in the ſituation of the parts, a tumour of the lips of the wound, grumes of congealed blood obſtructing the wound, or the fat preſſed into the wound, may hinder the paſſage of the probe when it has been introduced at the mouth of the wound. To theſe add, that the patient is often ignorant of the poſture he was in when the wound was inflicted.

2. As when warm water is injected by a ſyringe at the mouth of the wound: of which we treated in the commentaries on §. 300, nº 4.

3. For if from the figure of the wounding inſtrument, compared with the width of the wound, it ſhall appear to have penetrated deep and in a rectilineal poſition, we may then conclude the wound has paſſed into the cavity of the abdomen; and the reverſe, if from the ſame ſigns the wound ſhall appear to have been inflicted ſuperficially or obliquely. It is eaſily apparent, that a wounding inſtrument may penetrate to a conſiderable depth, without perforating the peritonæum, in thoſe who have their belly prominent with fat to the thickneſs of half a foot.

§. 307. IF theſe wounds penetrate almoſt as deep as the peritonæum, the integuments being there weakened, may give occaſion for a hernia to be formed in a robuſt patient; than which nothing can be worſe, if the fiſtulous wounds run obliquely betwixt the integuments of the abdomen.

To what a degree the peritonæum may be extended, is ſufficiently evident in women with child, and in thoſe afflicted with dropſies; from whence wounds, not penetrating the abdomen, have a circumſtance peculiar to themſelves, which being neglected has often produced

ced a train of the worſt conſequences. For the diaphragm being depreſſed at every inſpiration, all the contents of the abdomen are hereby compreſſed, and again in exſpiration they are repreſſed by the abdominal muſcles; whence it is evident, that the contents of the abdomen receive a continual preſſure from the diaphragm and muſcles of the abdomen. If therefore the equality of this preſſure be removed in any part by a wound in the integuments extending almoſt to the peritonæum, that membrane being eaſily dilatable, will be extended by the force of reſpiration ſo as to form a ſacculus, into which the inteſtines, omentum, *&c.* may enter, and form a *hernia*, which is no more than a dilatation of the peritonæum in ſome part, into which the contained viſcera of the abdomen may prolapſe or enter. For it is very rarely, if ever, that an hernia is formed by a rupture of the peritonæum, but almoſt conſtantly from an expanſion of that membrane into a ſacculus; notwithſtanding Celſus [a] ſeems to have been of another opinion: and we are taught by moſt certain obſervations, that ruptures may be formed in any part of the abdomen where the equable preſſure is removed from the peritonæum. In the dead body of a woman, an hernia was found on the left ſide of the linea alba, four fingers breadth above the navel, and which contained a portion of the omentum and inteſtinum colon. This rupture aroſe from a violent blow received on this part of the abdomen [b]. Sennertus [c] relates a wonderful caſe, which teaches us, that a weakneſs in any part of the abdomen may occaſion very large hernial tumours. A cooper's wife, in helping her huſband to bend one of the ſtaves, was by the return of it ſtruck on the left inguen. A ſmall tumour aroſe ſoon after in the part, which in a little time increaſed greatly. It afterwards appeared, that the increaſing uterus of this unhappy woman, big with child, had got into a large ſack formed by a dilatation of the integuments of the abdomen; in which place the motion of the

[a] Lib. vii. cap. 4. p. 413. & ibid. cap. 17. p. 454. [b] Acad. des Sciences, l'an 1714. p. 259. [c] Lib. iv. part. 1. ſect. 2. cap. 16. Tom. III. p. 39.

the living fœtus might be perceived both by the eye and touch: and as there ſeemed to be no other remedy left at the time of birth, the infant was delivered alive by the cutting open of the womb; at which time Sennertus being preſent, ſaw that the peritonæum was not ruptured, but entire, only conſiderably dilated by the bulk of the womb. After the cure of a wound in the abdomen, a conſiderable hernia was formed in the part where the wound had been made; which the patient neglecting, he ſix years afterwards died of a gangrene in that part [d]. Now the ſtronger the perſon thus wounded is, the more liable is he to a future rupture there, becauſe the preſſure acts ſo much the ſtronger on the reſt of the abdomen, whereby the weaker place will be more eaſily and ſpeedily dilated. To which add, that ſtrong bodies are uſually employed in violent exerciſes, whence the leaſt reſiſting parts will be again more dilated by the greater efforts of reſpiration.

Than which nothing can be worſe, *&c.*] It is well known, that a large quantity of fat is always ſeated upon the abdomen, unleſs the perſon is very lean; and this fat is not only ſpread upon the muſcles of the abdomen, but is alſo interpoſed every where betwixt them: if therefore a wound ſhould run obliquely betwixt the integuments of the abdomen, the extravaſated humours or matter there collected, and not meeting with a free egreſs through the mouth of the wound from ſome impediment, often burrows or makes its way ſurpriſingly through the ſubſtance of the panniculus adipoſus, and forms deep ſinuoſities betwixt the interſtices of the muſcles, in which caſe the cure becomes extremely difficult; and frequently it is even wholly impracticable to cure theſe fiſtulous ulcers following from wounds of the abdomen, ſince it is there neceſſary either to compreſs the bottom of ſuch a fiſtula by an artificial preſſure while its aperture continues open, or elſe to lay open all its meanders by inciſion. But that both theſe methods are often impoſſible to be uſed in thoſe caſes will readily appear to any one who conſiders the great thickneſs of the adipoſe membrane there,

[d] Tulp. Obſervat. Medic. lib. iii. cap. 20. p. 211.

there, and the interpoſition of it betwixt the interſtices of the abdominal muſcles. Celſus takes notice of theſe very bad fiſtulæ being formed here, when he ſays, *There is no bone placed under the abdomen; yet there are very bad fiſtulæ ſeated there, inſomuch that Soſtratus believed them incurable. But that they are not always incurable, experience demonſtrates* [e].

But Celſus believed fiſtulæ of the abdomen to be dangerous, chiefly becauſe, being laid open, they occaſion ruptures; and therefore he ſays, *A fiſtula ſeated oppoſite to the liver, ſpleen, or ſtomach, is leſs dangerous than one oppoſite to the inteſtines; not that the effects are there worſe in themſelves, but becauſe they there make way for another diſorder* [f]. Tulpius [g] laments an incurable fiſtula in a girl, which aroſe by a long and winding courſe from one of the ſpurious ribs which was carious. Many more of theſe caſes have been obſerved, of which we ſhall ſpeak more largely when we come to treat on fiſtulæ; it will be ſufficient at preſent to produce one or two inſtances. A captain received a wound, at the diſtance of two fingers breadth from the navel, by a ſword, which penetrated upwards and backwards: as the wound did not penetrate the cavity of the abdomen, it was only covered with a ſingle and flat pledgit and a plaiſter, ſo that on the next day it was cloſed. The abdomen was wonderfully painful and ſwelled for ſix days afterwards; but by the uſe of phlebotomy, and the application of emollient fomentations to the abdomen, the pain was abated, and the next day a ſmall prominent tumour appeared in the place of the wound; which being opened, diſcharged an incredible quantity of matter, and was perfectly cured in the ſpace of eight days [h]. In another wounded patient, the ſword entered the epigaſtrium at the diſtance of two fingers breadth from the linea alba: and as

[e] Ventri nullum os ſubeſt; ſed ibi perniciosæ admodum fiſtulæ ſunt: adeo, ut Soſtratus inſanabiles eſſe crediderit. Id non ex toto ita ſe habere uſus oſtendit. *Lib.* vii. *cap.* 4. *p.* 413.

[f] Tutior fiſtula eſt contra jecur et lienem et ventriculum, quam contra inteſtina; non quo pernicioſior ibi res ſit, ſed quo alteri periculo locum faciat. *Ibid.*

[g] Obſerv. Medic. lib. iii. cap. 28. p. 230, 231. [h] Traite complet de Chirurgie, par. M. de la Motte, Tom. III. p. 97.

as the ſword was flat, and eaſily flexible without breaking, it went according to the courſe of the ribs quite to the vertebræ of the back, from whence a fiſtulous ulcer was formed, the bottom of which being opened, a happy cure followed [i].

§. 308 THEREFORE in theſe wounds recourſe muſt be had to future and bandage: and then, in other reſpects, the treatment uſual in common wounds will ſuffice.

What has been ſaid of the cure of wounds in general is applicable to theſe; and will be ſufficient for the cure, if there is no danger of ruptures or fiſtulæ. Narrow and deep wounds of the integuments eaſily degenerate into fiſtulæ; and therefore care muſt be taken, by an artificial preſſure and a proper poſture of the patient, to prevent the confined humours from forming ſinuſes in the panniculus adipoſus. But the broader ſort of wounds in the integuments very much endanger ruptures, whence it will be proper to unite them by future, (ſee §. 214.) and to ſecure the weakened part by an artificial application of compreſſes and bandages, that the contents of the abdomen being preſſed there may not dilate the peritonæum. But ſince every ſtrong effort in reſpiration is here very pernicious, therefore every thing which occaſions the perſon to breathe ſtronger than uſual ought to be ſtudiouſly avoided: and more eſpecially care muſt be taken not to retain inſpired air by ſhutting the larynx, as is done, for example, in diſcharging the fæces of the inteſtines, eſpecially when a ſtrong effort is required to expel the indurated fæces. Therefore the bowels are to be cleanſed with an emollient clyſter: and then the diet ought to be of ſuch food as affords the leaſt quantity of groſs fæces to be collected in the inteſtines; ſuch, for example, is the broth of fleſh, with which alone life may be ſupported, and yet the patient may without damage continue a month without going to ſtool, becauſe there

[i] Ibid. p. 108—113.

are ſcarce any fæces thence accumulated in the inteſtines. For the ſame reaſon the urine ought alſo to be retained for a conſiderable time, that it may be diſcharged almoſt ſpontaneouſly and with little or no ſtraining. If any cough ſhould attend, that muſt be appeaſed with diacodiates: laughing, calling out aloud, ſneezing, and the like, are to be avoided as much as poſſible; and for the ſame reaſon abſolute reſt ought to be enjoined.

§. 309. BUT that ſuch a wound *does* penetrate into the cavity of the abdomen will appear, 1. By the probe, and poſture of the patient; 2. By injections; 3. By a knowledge of the wounding inſtrument, and nature of the wound: 4. By the egreſs of the contained parts.

We have already treated of the ſigns compriſed in the three former numbers of this aphoriſm, at §. 306. and §. 300, n° 1, 2, 4.

4. If thoſe parts which we know are contained in the cavity of the abdomen come out through the wound, no doubt can then remain but the wound has certainly penetrated into the cavity of the abdomen. But more eſpecially the omentum and inteſtines fall out, when the abdomen is perforated. It is eaſy to diſcover when the inteſtines are prolapſed; but in corpulent people, the fat being free from the preſſure of the divided ſkin, often protuberates through the mouth of the wound, and reſembles the fat of the omentum, which may occaſion an error in the diagnoſis of a wound. At the ſame time alſo a wound penetrating into the cavity of the abdomen may be ſo obſtructed or cloſed by this protruſion of the fat, that neither the probe nor the injection of warm water can diſcover that it penetrates. If in ſuch a wound there is a diſcharge of any of the humours belonging to the abdominal viſcera, as blood, urine, bile, *&c.* of which we ſhall treat in §. 312. this is an evident ſign that the wound not only penetrates the cavity of the abdomen, but has alſo injured ſome of the parts therein contained.

§. 310. BUT if all the ſymptoms are ſlight, without pain, fever, or inflammation; if no blood comes from the wound when the patient lies upon it; and if the injected liquor returns unaltered in its colour; we then know that the internal parts are not injured.

After the ſigns make it evident that the wound has penetrated into the cavity of the abdomen, the next inquiry muſt be, whether or not any of the viſcera or veſſels contained in that cavity have received hurt. But ſince all the viſcera conduce to health by their functions, it will immediately appear, that if no great diſturbance of the functions depending on the continuity of thoſe viſcera can be obſerved, then no part of any moment is injured in the abdomen. And as the abdominal viſcera are principally ſubſervient to chylification; therefore, if the retention and converſion of the aliments into chyle, the abſorption of that, and the expulſion of the remaining fæces, are performed as they uſually were in health, we may be certain that the wounding inſtrument has not injured any of the abdominal viſcera, notwithſtanding its having penetrated into the cavity of the abdomen. But as the organs, which ſerve for the ſeparation and diſcharge of the urine and to generation, are (with ſome impropriety, becauſe ſeated without ſide the peritonæum) ſaid to be ſeated in the abdomen; therefore inquiry muſt be made, whether any of the ſymptoms conſequent on the wound indicate theſe parts to be injured.

Beſides theſe injuries of the abdominal viſcera, it ſometimes happens, that barely a diviſion of the nerves in the meſentery produces the moſt dangerous ſymptoms, and even death, as we obſerved from Ruyſch in the comment on §. 170. n° 3. But, in that caſe, the intenſe pain, fever, and inflammation, ſufficiently declare the danger that is preſent. Therefore if theſe ſymptoms are abſent, there is all the reaſon imaginable to expect a happy cure. But alſo the large veſſels, which convey blood, chyle, and lymph, may be injured by

wounds in the abdomen; and therefore, if the patient lies upon the wound, ſufficiently large or open, and no blood or other juice is diſcharged, we thence know that thoſe veſſels are not injured: but as extravaſated blood may congeal, and remain in the cavity of the abdomen without running out through the wound, therefore the ſurgeon injects warm water with a ſyringe at the mouth of the wound; which returning unaltered, nothing of this nature can be feared. But it muſt be remarked, that in an healthy living perſon the cavity of the abdomen is always full of moiſt vapours, which appear very manifeſtly upon opening the belly of an animal juſt killed: and theſe being condenſed by the cold of the air admitted, or by any other cauſe, may flow from the wound in form of a condenſed and collected lymph, though none of the internal veſſels are injured.

§. 311. THE air muſt be immediately excluded; and that which entered muſt be expelled, by ſucking, and the effort of exſpiration: the integuments are then to be ſewed together by the operation termed gaſtroraphia, laying aſide the uſe of tents: and thus the cure of the wound will be compleated, by dreſſing ſeldom, and with vulnerary balſams; and by the patient's lying upon the wound, keeping to a ſpare, moiſt, and healing diet, with reſt of body.

The air muſt be excluded, *&c.*] When it appears, from the ſigns before deſcribed, that none of the contained parts in the abdomen are injured, ſuch a wound then requires to be immediately healed up. But it is to be obſerved, that the air will ſometimes enter through the wound; and being retained in the cavity of the abdomen, it may be there greatly rarefied and expanded by the heat, ſo as to compreſs all the viſcera, if it be hindered from eſcaping again through the wound. Now from this air inſinuating itſelf into the panniculus adipoſus may ariſe wonderful emphyſemata, as we obſerved

ſerved in wounds of the thorax at §. 300, n° 5. Therefore, before the conſolidation or cloſing of ſuch a wound is attempted, one ought to be ſatisfied that no air remains in the cavity of the abdomen: or if there is, it muſt be diſcharged in the manner we directed in §. 304. namely, by cauſing the patient retain the inſpired air as long as he well can, and then to make a ſtrong effort of exſpiration while the larynx is ſhut; for thus the contents of the abdomen will be ſtrongly compreſſed by the deſcent of the diaphragm and contraction of the abdominal muſcles during the effort of exſpiration, and thus the confined air will be expelled through the mouth of the wound. But to prevent the omentum or inteſtines from being forced out at the ſame time, the wound may be covered with a piece of open linen, which will tranſmit the air and reſtrain the other parts from coming out.

The air being thus excluded, it is then required, by the general indications for the cure of all wounds (§. 185, n° 3.) to unite again the parts which have been ſeparated by the wounding inſtrument, and to retain them in that union; and this, in wounds penetrating the cavity of the abdomen, is performed by a particular method, namely,

By ſewing together the integuments.] This operation has been long ago deſcribed by the ancients, who ſeem to have attempted it different ways. Galen [a] fearing leſt the divided lips of the peritonæum ſhould not conjoin with each other, becauſe he judged a membrane to be nervous and bloodleſs, would therefore have this operation performed ſo, that the divided lips of the peritonæum might unite with the oppoſite ſides of the wounded lips of the abdomen. For he orders the needle to be carried from without inwards through the ſkin, without perforating the peritonæum; and then with the ſame needle he ſews the peritouæum, with all its incumbent integuments, to the oppoſite ſide of the wound: which done, he afterwards paſſes the needle through the ſame ſide of the wound from without inwards, perforating the ſkin and muſcles again without touching the peritonæum; and then again, on

[a] Meth. Med. lib. vi. cap. 4. Charter. Tom. X. p. 140, 141.

the oppoſite ſide he perforates the peritonæum, and ſews it to all the incumbent integuments, by paſſing the needle from within outwards. By this method he endeavoured to cauſe the divided peritonæum to unite with the oppoſite ſide of the divided abdominal muſcles. But there is ſtill another method propoſed by Galen in the ſame place for performing the gaſtroraphia, by which the parts are united and conſolidated each with its fellow, *viz.* the peritonæum with the peritonæum, and the muſcles with the muſcles, *&c.* and which therefore ſeems to be the better method of the two. Celſus [b], in deſcribing this operation, orders it to be performed ſo as to make the future firſt upon the moſt internal membrane; and that being done, to paſs the ſame needle and thread through the ſkin, and to unite the lips of the wound by future in the ſame manner: for, ſays he, neither the future of the ſkin, nor of the peritonæum, will be ſufficient alone; but both are neceſſary. He would alſo have the future performed with two threads, and thicker than are uſual in other wounds; becauſe they may be more eaſily broke by the motion of the abdomen, and becauſe the parts here are not expoſed to ſo great an inflammation. In making this future, it is principally required to give the patient as little pain as poſſible, and to avoid injuring either the omentum or inteſtines; nor is there any danger of the future being torn open by the continual motion of the abdomen. But ſince the ſkin of the abdomen is very tough and difficult to perforate, as all thoſe have experienced who have ſewed up the abdomen after it has been opened in dead bodies; therefore it is required to have the needles very ſharp-pointed, and with cutting edges, extending to about a third part of the length of the needle, which is to be ſo far crooked, and the remainder ſtraight. The thread muſt be ſtrong, or elſe ſeveral times doubled, not twiſted together, but diſpoſed in the ſame plane, the extremities of which are to be paſſed through the eyes of two of the forementioned needles; and then the point of one needle, being concealed by the fleſh of the fore-finger, is

[b] Lib. vii. cap. 16. p. 453.

is to be cautiouſly conveyed under the peritonæum in the cavity of the abdomen, to avoid injuring the omentum or inteſtines; then let the peritonæum and integuments be perforated, by paſſing the needle at about the diſtance of a finger's breadth from the edge of the wound. In the ſame manner, let the oppoſite lip of the wound be perforated with the other needle; and the thread, being drawn through, is to be afterwards tied in a knot upon ſmall compreſſes firſt placed underneath for that purpoſe. In this manner is the ſuture to be repeated according as the length of the wound requires. What elſe is neceſſary to be obſerved in performing the operation of gaſtroraphia may be ſeen in Garengeot [c] and the other writers on operations; ſee alſo what has been ſaid in the commentary on §. 214.

The uſe of tents is to be laid aſide.] For theſe are in this caſe pernicious; ſince the divided parts require to be united, which union will be always impeded by the interpoſition of any foreign body. But the pernicious conſequence of uſing tents in wounds of the abdomen has been ſhewn both from reaſon and experience by Belloſte [d].

By the patient's lying upon the wound, and dreſſing it with balſam, *&c.*] Since the union of the lips of the wound requires them to be brought together by ſuture, their conſolidation may be procured barely by dreſſing with a ſmall quantity of ſome vulnerary balſam, or the application of a ſmall pledgit moiſtened with the like balſam, agreeable to what we obſerved under the cure of wounds in general §. 204. But the poſture of the patient is required to be ſuch, that the matter and other extravaſated juices may have a natural tendency to be diſcharged from the wound, which muſt therefore be lain upon. Abſolute reſt is here required; becauſe motion of the body, coughing, laughing, ſneezing, or difficult going to ſtool, augments the force of reſpiration, ſo as to endanger a laceration of the ſuture; or at leaſt thoſe violent motions of the abdomen would diſtract the threads, and irritate the conjoined parts, whence

[c] Traite des Operations de Chirurgie, Tom. I. p. 124, *&c.*
[d] Chirurgien d'Hopital, Part. II. chap. 15. p. 114, *&c.*

whence inflammation, pain, and their bad conſequences, may follow. For thoſe reaſons, alſo, a moiſtening and mild diet is neceſſary to be taken in a ſmall quantity at a time, to avoid a repletion and diſtenſion of the ſtomach and abdomen; fleſh-broths are principally recommended here, as we obſerved in the commentary on §. 308. If now neither pain, itching, nor inflammation, *&c.* follow, ſeldom dreſſing of the wound will haſten the cure, as we ſaid before in the cure of wounds in general.

§. 312. BUT if the pain is acute, and there are ſigns of a fever or inflammation; or if the wound diſcharges blood, ichor, food, drink, or chyle; or elſe if it diſcharges matter, bile, urine, or fæces, with a ſtench; in theſe caſes, by conſidering the wounding inſtrument, with the ſituation and nature of the wound, the paleneſs, inquietude, faintings, cold ſweats, and deficient pulſe in the patient; all theſe will indicate, that ſome, and which, of the abdominal viſcera are injured.

Hitherto we have conſidered wounds of the abdomen, which either injure the common integuments only, the peritonæum remaining entire; or which penetrate into the cavity of the abdomen, but without injuring any of the contained viſcera or veſſels. We come now to thoſe ſigns, by which we know, that ſome of the contained parts of the abdomen are wounded; and from which ſigns may be concluded what theſe parts particularly are. But all theſe ſigns are taken from the matters diſcharged through the wound, or elſe from the impaired functions.

Acute pain.] This is a ſymptom highly to be ſuſpected in wounds of the abdomen, as it denotes that ſome of the membranous or nervous parts are injured. But how dangerous injuries of theſe parts are, may appear from what has been ſaid in §. 170, no 3: where it is evident, from the obſervations of Ruyſch, that wounds inflicted on the meſentery, without injuring any

any other parts, have produced the moſt excruciating pains of the abdomen, and proved fatal within two or three days; and it alſo appears very probable, that all theſe ſymptoms follow from the injured nerves in the meſentery. Celſus [b] enumerates among the ſigns of a wound in the liver, ſhooting pains extending to the throat, and very ſevere where the neck is joined to the ſcapula of the ſame ſide. In wounds of the kidneys, he obſerves, that the pain deſcends to the groins and teſticles: and by the parts of generation in the female being wounded, he ſays, a pain is excited in the groins and hips.

Fever:] Which, if it does not ariſe from a diſturbance of the mind in the patient, is always the conſequence either of ſevere pain or inflammation; which muſt be always very dangerous in theſe nervous parts, as the meſentery, inteſtines, *&c.*

Inflammation:] The ſigns of which are, a ſhivering, and the feveriſh heat which follows, with thirſt, anxiety, difficult reſpiration, a hard pulſe, dry tongue, *&c.* And how fatal an inflammation is in moſt of the abdominal viſcera, we are taught by the iliac paſſion and hernia incarcerata; in which diſeaſes even the moſt robuſt people periſh in a few hours time.

Blood:] Which denotes that ſome of the larger blood-veſſels are injured; and that it is arterial, if it is diſcharged impetuouſly and is of a very florid colour; but venal, if it appears of a darker colour.

Ichor.] Such a thin liquor may be diſcharged from various parts injured by the wound penetrating the abdomen. There are here a great many lymphatic veſſels, which may diſcharge ſuch a juice; or if the pancreatic duct, porus hepaticus, or pelves of the kidneys are wounded, they may diſcharge an incredible quantity of ſuch an ichor into the cavity of the abdomen. Even the vapours, which repleniſh the cavity of the abdomen in an healthy animal, being diſcharged from the perſpiring veſſels, and condenſed by the cold of the air admitted through the wound, without being abſorbed again by the veins, will be here collected, and often diſ-

[b] Lib. v. cap. 26. p. 286.

diſcharged in a very conſiderable quantity from the mouth of the wound, though none of the internal parts be injured.

Food and drink.] Theſe denote that the ſtomach is injured: wounds of which are always dangerous; tho' not abſolutely mortal, as appears from what has been ſaid in the commentary on §. 170, n° 5. to which we may add the inſtance related in the Miſcellanea Curioſa[b], of a man, whoſe ſtomach was wounded; and the lips of the wound, becoming callous, did not unite, but part of the food and drink were diſcharged thro' the opening during the ſpace of eleven years.

Chyle.] If this is diſcharged through the wound, it denotes, that the ſmall inteſtines are injured, or that the chyliferous ducts are wounded; in which latter caſe the colour of the chyle is much whiter: whereas the chyle of the ſmall inteſtines always appears more of a grey or aſh colour; and when theſe are wounded near the ſtomach, where the bile mixes itſelf, the chyle appears then of a yellowiſh colour.

Bile.] Which denotes a hurt either of the common or cyſtic duct, or of the duodenum in or near that part where it receives the common duct; but more eſpecially a large quantity of bile is diſcharged from the cavity of the abdomen when the gall-bladder itſelf is wounded. There is a very remarkable caſe of this nature related in the Philoſophical Tranſactions[c], of an officer, who received a wound penetrating the cavity of the abdomen, and entering the bottom of the gall-bladder, without doing any conſiderable injury to the other adjacent parts. The ſymptoms which followed this wound were very ſurpriſing: for the abdomen was immediately diſtended, as if the patient had been afflicted with an aſcites or tympanites; nor did the ſwelling either increaſe or diminiſh till the patient's death, which happened a week after the infliction of the wound. There were no belchings, flatus, or rumbling noiſe; and the bowels continued ſtrictly conſtipated during the whole time, notwithſtanding ſtrong purges and clyſters

[b] Decad. 2. ann. 5. p. 2. [c] N° 414. p. 341. Abridgm. Tom. VII. p. 571, 572.

clyſters were adminiſtered. The patient had ſcarce any ſleep, though opiates were given in a very conſiderable doſe. The wound appeared externally pale, flaccid, and without matter. The pulſe was ſtrong, equal, and ſlow; but the day before death it was ſometimes a little intermitting, and the patient's ſenſes continued even till death: a ſlight hickup and nauſea attended the fifth day after the wound was inflicted. From this hiſtory it is evident, that a diſcharge of bile from a wound of the abdomen is a very bad ſign.

Matter.] Which denotes a ſuppuration made in the internal parts from the inflicted wound; unleſs perhaps the patient ſhould have had a purulent vomica before, which the wounding inſtrument has now opened.

Urine:] Which being diſcharged from the wound, evidently ſignifies, that the pelvis, ureter, or bladder, is injured.

Fæces or ſtench.] It appears from phyſiology, that the ingeſted aliments are by degrees ſo drained by the action of the ſtomach and ſmall inteſtines, (the more fluid parts being abſorbed by the bibulous mouths of the meſeraic and lacteal veſſels,) that towards the end of the inteſtinum ilium ſcarce any thing more than the inſoluble fæces remain, which ſlip into the inteſtinum cæcum, from whence they are by degrees protruded through the whole length of the colon to the rectum, where they make their exit. Now it has been obſerved, that no ſtench (which is the ſign of incipient putrefaction) is perceptible in thoſe relicts of the chyle, unleſs in the cæcum, colon, and rectum; but never in the ſmall inteſtines. For this reaſon Helmont [d] ſays, That a ſtercoraceous ferment is ſeated in the inteſtinum cæcum, not for the buſineſs of nutrition but putrefaction. When therefore the fæces are diſcharged through the wound, or when their fetid ſmell is expired through the wound, we may conclude that the large inteſtines are injured. Hence Celſus [e], after ſaying that a wound in the ſtomach and ſmall inteſtines have the ſame ſigns, adds, That the other inteſtines being wounded

[d] Ortus Medicin. p. 179. nº 81. in fine capituli, *Sextuplex digeſtio Elementi humani.* [e] Lib. v. cap. 26. p. 287.

wounded, either discharge the fæces or their smell.

The wounding instrument, with the nature and seat of the wound.] If the instrument can be obtained with which the wound was inflicted, by comparing it with the width of the wound, it will often indicate how far the wound has penetrated. It is also evident, that the nature of the wound varies much according to the different direction in which the instrument entered the cavity of the abdomen, either upward, downward, laterally, *&c.* The situation likewise of the abdomen and viscera may differ much according to the different posture of body which the patient was in at the time when he received the wound, and also according to other different circumstances. Thus the very accurate anatomist, Winslow, has observed [f], that the liver in the human body is so firmly attached by its ligaments, that it cannot easily slip from one side to the other; yet that it is not absolutely suspended by them, but is in part sustained by the stomach and intestines, especially when they are full. Hence, after long fasting, the liver descending by its own weight, pulls down the diaphragm, and occasions an uneasy sensation, which the same anatomist thinks is unjustly ascribed to the stomach. Therefore, if a man be wounded when the stomach is empty and he in an erect posture, at the distance of about two fingers breadth under the false ribs on the right side, in that case the liver may be hurt, as it descends below the margin of the ribs; and of this nature we have an instance related by Garengeot [g] of a man who died of such a wound, upon opening whose body an abscess appeared in the liver from this cause. The same is also true of the stomach, which when full frequently descends to a considerable degree.

Paleness, cold sweat, inquietude, fainting, and deficient pulse.] All these signs denote a deficiency in the vital powers, and generally follow a great loss of blood. Therefore, when these signs appear without any flux of blood externally from the wound, we may then suspect an internal hæmorrhage, and conclude that

f Exposition Anatomique, &c. Traite du bas ventre, nº 267, 268. p. 350. g Traite des Operations de Chirurgie, Tom. I. p. 84.

that the large blood-veſſels are injured: for the blood, being thus extravaſated within the cavity of the abdomen, returns only in a ſmall quantity to the heart, the force of which will be therefore diminiſhed: whence the pulſe begins to weaken, intermits, and at length wholly ceaſes in a perfect ſyncope. Hence paleneſs from a collapſion of the empty blood-veſſels, and a cold ſweat; which are certain marks of weakneſs in the vital powers. Then begins that ſtruggle of life with death which is commonly called an agony; namely, extreme anguiſh and inquietude, ſo that they are continually changing the poſture of their body ſo long as their ſtrength will permit; and at length a deliquium, or death itſelf, follows. Conſult what has been ſaid in the commentary on §. 302, n° 7.

Sometimes, perhaps, theſe ſymptoms may ariſe from an injury of the nerves which are diſperſed through the viſcera of the abdomen. For that theſe nerves have a very great influence upon the vital functions, we are taught by ſudden deaths which follow from the inverſion of an inteſtine, or incarcerated rupture, *&c.* even in the moſt healthy and robuſt people; in which diſorders all theſe ſymptoms appear, and are often followed with death in a few hours. Hence Celſus [h], enumerating the ſigns of a wound in the ſtomach, ſays, That the pulſe languiſhes, and thin ſweats ariſe, in which the extremities grow cold; and immediately afterwards adds, That the ſigns of a wound in the ſtomach and inteſtines are the ſame.

From all theſe ſigns we know, that the parts contained in the cavity of the abdomen are injured; and frequently it is ſufficiently evident from the ſame ſigns, which of the contained parts are affected: So that from hence we have a *diagnoſis* of theſe wounds; and in the following aphoriſm we are taught their *prognoſis*.

§. 313. THEN follow an infinite number of diſorders, partly, 1. From the nature of the viſcera, which are not muſcular, but com-

[h] Lib. v. cap. 26. p. 287.

compoſed of thin veſſels, in which the circulation is difficultly performed, and not unleſs the abdomen be entire; 2. From an injury of the function of the viſcus; 3. From the quantity and putrefaction of the extravaſated blood; 4. From the preſſure, rarefaction, and injury received from the air which has entered through the wound.

1. It appears from phyſiology, that all the abdominal viſcera, which are ſubſervient to chylification, tranſmit all their venous blood to the ſinus of the vena portæ, which immediately after divides and diſtributes all the received blood throughout the whole maſs of the liver in ſuch a manner, that the blood no longer flows from ſmall to larger branches, but from a broad baſis to narrow extremities, as in the arteries. Hence it is evident, that the circulation of the juices muſt be here very difficult; ſince the venous blood having loſt the greateſt part of its motion, which it received from the heart and arteries, is here again obliged to paſs through the narrow and converging veſſels of the liver. But then this circulation of the juices is promoted by the action of the diaphragm and abdominal muſcles, which preſs alternately upon all the abdominal viſcera: for at the time of inſpiration the diaphragm tends downward, and diminiſhes the cavity of the abdomen, compreſſing all the contained parts; but, at the time of exſpiration, the muſcles of the abdomen contract and re-act in the ſame manner upon the viſcera. Hence the circulation of the blood is promoted through the abdominal viſcera every moment of life by theſe alternate preſſures: and from hence ſo frequently ariſe obſtinate obſtructions about the liver, ſpleen, and other viſcera of the abdomen, in ſuch people as, leading a ſedentary and unactive life, neglect the healthy exerciſes of the body, and from whence follow many of the moſt obſtinate chronical diſorders. When, therefore, this action of the diaphragm and abdominal muſcles is diſturbed or aboliſhed by a wound; it is evident that this preſſure will be wanting, which is required to promote the circulation of the juices through the abdominal viſcera.

This

This appears evidently in the diſſection of living animals; for when the abdominal muſcles are divided by tranſverſe inciſion, all the veins of the abdominal viſcera will in a few minutes time appear very much diſtended, becauſe the venous blood cannot obtain a free courſe through the ſmall veſſels of the liver for want of this action of the abdominal muſcles. In the mean time it is very evident, that this bad conſequence is not to be apprehended from all wounds of the abdomen, but only from thoſe which conſiderably injure the action of the diaphragm or abdominal muſcles. Add to this, that the air ruſhing in through large wounds, may by the coldneſs of it, to which the abdominal viſcera are unaccuſtomed, very much injure them; and from theſe two cauſes may be deduced the reaſon why the omentum or inteſtines ſo eaſily mortify when they prolapſe through a wound.

2. Each of theſe viſcera have their particular uſes ſubſervient to the buſineſs of chylification, and therefore an injury of one or more of them will diſturb the formation of the chyle. Thus, for example, if one of the ſmall inteſtines be divided near the pylorus, all the chyle will eſcape into the cavity of the abdomen, or be diſcharged through the wound; and the body being thus defrauded of its nouriſhment, the patient will periſh by a true maraſmus. A wound of the gall-bladder will extravaſate that important juice into the cavity of the abdomen, as in the caſe we related under the preceding aphoriſm; whence the bowels will remain obſtinately bound up, without being relieved by any medicines, accompanied with a ſudden and laſting inflation of the abdomen, which are conſequences that one would not eaſily foreſee to happen from ſuch a wound. Hence it is alſo evident, how neceſſary the action of the bile is towards that of moſt of the abdominal viſcera. But the bile is formed from the venous blood coming from all the chylificative viſcera, and perhaps of a different nature in each, being alſo wonderfully changed by the ſtructure of the liver itſelf: whence an injury of the abdominal viſcera frequently deſtroys ſomething neceſſary to the ſecretion of good bile; and

the bile therefore degenerating from its healthy or natural ſtate, the formation of the chyle may be wonderfully diſturbed. Thus the liver and ſpleen appear like a ſponge full of blood; and therefore a quantity of blood being extravaſated from a wound in either of theſe, may produce inflammation, ſuppuration, or a converſion of thoſe viſcera into corrupt matter, *&c.*

3. A diviſion of the blood-veſſels, which are diſtributed in ſuch numerous and large branches through the viſcera of the abdomen, may evidently extravaſate a large quantity of blood into the cavity of the abdomen, where it may be hurtful by its weight compreſſing the viſcera, and alſo by its putrefaction, eſpecially if the air is freely admitted at the ſame time. But a ſmall quantity of extravaſated blood, without any conſiderable injury of the important viſcera, is not judged very dangerous by Ruyſch [a], eſpecially if the free acceſs of the air is prevented. That anatomiſt, having firſt tied the ſplenic veſſels in a dog of a moderate ſize, afterwards cut out the ſpleen; but neglected to tie up the ſmall epiploic artery, which diſcharged ſo large a quantity of blood, that the dog ſeemed as if he would ſhortly expire. He nevertheleſs protruded the artery without ligature into the abdomen, where it doubtleſs continued to bleed: he then united the wound of the abdomen by ſuture; and the dog afterwards did well, the wound healing in ſix or ſeven days time. From this experiment he concludes, that blood extravaſated into the cavity of the abdomen, may be again abſorbed, without any bad conſequence following, provided the air is excluded.

4. If air enters through the wound into the cavity of the abdomen, and the orifice of the wound is in the mean time obſtructed by the fat or any other cauſe, ſo as to prevent the air from eſcaping again, it may be rareſied by the heat of the body, and diſtend the abdomen to an immenſe bulk: but at the ſame time it will compreſs all the viſcera contained in the abdomen, more eſpecially the ſtomach and inteſtines, which it may preſs quite flat; whence may follow miſerable con-

[a] Obſervat. Anatom. Chirurg. 66.

conſequences, which can only be remedied by diſcharging the rarefied air.

§. 314. FROM hence theſe wounds are often mortal. But large wounds of the inteſtines which are acceſſible to the hand, muſt be conjoined by ſuture; or if the inteſtines are injured with ſmall wounds, they may be left to themſelves, and the remainder of the treatment performed as we directed at (311.)

From all that has been ſaid it is evident, what a great diverſity there is in wounds penetrating the cavity of the abdomen, and injuring the contained viſcera or veſſels. If, now, we conſider what has been already ſaid concerning the mortality of wounds in general, §. 170, nº 3, 5; together with the wonderful diſorders which have been obſerved to follow a hurt of the diaphragm, of which we treated in the ſame ſection at nº 4; it will eaſily appear, that inevitable death muſt be frequently the conſequence of wounds in the abdomen.

We come now to conſider what ought to be done in the cure of wounds in the abdomen, when the inteſtines are injured, and are acceſſible to the hand. Hippocrates [a] has pronounced wounds of the ſmall inteſtines to be mortal: but Galen, in his commentaries, will not allow that every kind of wound in the ſmall inteſtines is mortal, but only ſuch as penetrate into their cavity; and theſe, he ſays, are very rarely cured. In another aphoriſm Hippocrates [b] ſays, that one of the ſmall inteſtines being divided, will not again unite. Celſus likewiſe affirms, *If one of the ſmaller inteſtines is perforated, no good can be done. But one of the larger inteſtines may be conjoined by ſuture: not that the cure will certainly follow by that means, but becauſe a doubtful remedy is better in a deſperate caſe than none at all; for ſometimes it is healed* [c].

[a] Aphor. 18. ſect. 6. Charter. Tom. IX. p. 257. [b] Ibid. 24. ſect. 6. p. 261.

[c] Si tenuius inteſtinum perforatum eſt, nihil profici poſſe. Latius inteſtinum

But it appears at preſent, from a great many faithful obſervations, that the ſmall inteſtines have been entirely divided, and yet the patient has afterwards recovered. If therefore the inteſtines have received a ſmall wound, not ſufficient to let the contents into the cavity of the abdomen, they may be left to themſelves, for in that caſe the cure eaſily ſucceeds ſpontaneouſly. For ſo ſoon as the inteſtines have prolapſed through the wound, they are uſually greatly diſtended with flatus, if they are entire; and they then appear very thin and membranous: but if we conſider them in their natural ſtate, they appear ſufficiently thick and compact, ſo that a ſmall wound cannot much injure them. It is evident, from the inſtance of the madman, (mentioned in §. 170, n° 5.) who inflicted eighteen wounds in his own belly, that ſuch wounds of the ſmall inteſtines may heal ſpontaneouſly, as we are taught by the cicatrices of the healed wounds which appeared in the body after death. When the ſmall inteſtines of a dog were cut open longitudinally, as we mentioned in the ſame place; upon returning them into the abdomen without any future, the animal afterwards recovered. And obſervations teach us, that even pretty large wounds of the inteſtines have been cured ſpontaneouſly, tho' they were ſufficient to let out the contents. A man was wounded with a large bullet, which perforated the cavity of the abdomen, and entered the inteſtinum colon, with conſiderable damage, inſomuch that for the ſpace of two months the fæces were diſcharged through the wound; but at length the wound healed without any aſſiſtance from art, and the man perfectly recovered [d]. An eminent cook was wounded in the abdomen with a knife, ſo that the edge penetrated the larger inteſtine or colon on the right ſide; and though it hung out of the body for above the ſpace of thirty hours, and was very much injured by the cold, yet it was returned again into its place without any bad conſequence. The inteſtinal fæces were diſcharged daily through the mouth

teſtinum ſui poteſt: non quod circa fiducia ſit, ſed quod dubia ſpes certa deſperatione ſit potior; interdum enim glutinatur. *Lib.* vii. *cap.* 16.

[d] Belloſte Chirurgien d'Hopital, p. 266. Part. III. chap. 15.

mouth of the wound; and though the abandoned glutton obſerved no regimen of diet, yet the wound of the inteſtine was happily conſolidated, as appeared in the dead body ſix years after the wound was inflicted [e].

But when wounds inflicted on the inteſtines are ſo large, that there is reaſon to fear their contents will eſcape into the cavity of the abdomen, where, being accumulated and putrefied, they may corrupt all the adjacent parts; in this caſe, if the wound of the inteſtine is acceſſible to the hand, it will be proper to make the future. In theſe caſes ſurgeons generally uſe what they call the *glover's future*, becauſe the ſkins of animals where torn are uſually mended by the dreſſer with this kind of future. This future is performed upon the inteſtine by perforating both the divided lips at the ſame time, with a needle armed with a flat ſilken thread; then the ſecond ſtitch is made as before, at about the diſtance of two lines from the firſt, always beginning at one and the ſame ſide of the inteſtine, and repeating it till the lips of the wound are contiguous; thus will the divided lips of the inteſtine be retained in contact, by a ſpiral circumvolution of the thread, a pretty long piece of which is to be left pendulous out of the wound, that it may be afterwards eaſily extracted from the conjoined inteſtine. On this account the ſtitches are to be made at larger diſtances, and the ends of the thread are not to be continuous with the ſpiral circumvolutions, which retain the lips of the inteſtine, as many authors direct; for then the threads cannot be drawn out of the wound without wrinkling the future of the inteſtine, which will produce acute pain, inflammation, gangrene, *&c.* Upon this future conſult Garengeot [f], who has given the beſt deſcription of the method of performing it.

It is very apparent, that this future ought not to be performed but in caſes of urgent neceſſity, ſince it requires the inteſtine to be drawn out of the abdomen, and to be roughly handled for a conſiderable time in the cold air; from whence fatal conſequences have been ob-

[e] Tulpii Obſervat. Medicar. lib. iii. cap. 20. p. 211. [f] Traite des Operations de Chirurgie, Tom. I. p. 105, &c.

obſerved to follow. But the inſtances which we alledged in the commentary on §. 170, n° 5, where the ſtomach itſelf, divided by a wound, was conjoined by future; and the inſtances which we ſhall hereafter produce in the commentary on §. 317; ſufficiently prove that this operation ought not to be condemned as uſeleſs or pernicious.

§. 315. IF the inteſtine comes out uninjured through a large wound of the abdomen, let it be fomented by the application of live animals ſlit open, or with a proper fomentation, until it is replaced; and let the reſt of the treatment be performed as in (311.)

So long as the inteſtines remain in the abdomen, they are on all ſides moiſtened with warm vapours, and lubricated with a ſubtile oil, as we may be convinced barely from touching them in the diſſection of living animals. Therefore when the inteſtines prolapſe thro' a wound of the abdomen, being deprived of their moiſt and warm vapours, they ſoon become cold, dry, and often ſpeedily tend to mortification; which we know chiefly by their change of colour. Celſus has beautifully expreſſed himſelf upon this ſubject, when he ſays, *It muſt be directly conſidered whether the inteſtines are ſound, or whether they retain their colour*, &c. *Then if either of the inteſtines, whether large or ſmall, appears livid, pale, or black, and without ſenſe, which is a neceſſary attendant of theſe changes in colour, all remedies are ineffectual: But if the inteſtines as yet retain their colour, aſſiſtance muſt be very ſpeedily given; for they are ſoon changed by the unuſual contact of the ambient air* [a]. And that he well underſtood that the inteſtines are naturally moiſtened, not only with a thin lymph, but alſo

[a] Protinus conſiderandum eſt, an integra ea ſint; deinde, an his color ſuus maneat, *&c.* Tum, ſi utrumlibet inteſtinum (craſſum nempe et tenue) lividum, aut pallidum, aut nigrum eſt; quibus illud quoque neceſſario accedit, ut ſenſu careat, medicina omnis inanis eſt. Si vero ea adhuc ſui coloris ſunt, cum magna feſtinatione ſuccurendum eſt: momento enim alienantur, externo et inſueto ſpiritu circumdata. *Lib.* vii. *cap.* 26. *p.* 452.

lſo with a fat oil, is very apparent; becauſe he ſoon fter adds, *But if the inteſtines appear drier than they ught to be, they are to be fomented with water, to which little oil is to be added*[b]. When therefore the gyri of he inteſtines prolapſe through a large wound, they are o be immediately replaced, if they are not yet become old or dry. The retaining of the inteſtines will be nuch facilitated, if the patient is placed in ſuch a poture, that the contents of the abdomen cannot preſs pon the part wounded by their own weight. Celſus[c] vould therefore have the patient laid upon his back, vith his hips raiſed: For in that poſture the viſcera, ontained in the cavity of the abdomen, preſs the diahragm into the cavity of the thorax; by which means he capacity of the abdomen is increaſed, ſo that the rolapſed inteſtines may be more eaſily replaced. In nis reduction of the inteſtines, Celſus again very well dviſes, *That the ſurgeon ſhould always operate ſo as to eturn thoſe inteſtines firſt which prolapſed laſt, that each f their gyri may keep its place. After they are all replaced, the perſon is to be gently ſhook, that each of the nteſtines may reduce itſelf to its proper place, and there emain*[d]. For unleſs this be obſerved, violent gripes nd many other bad conſequences may follow.

Another admonition, of no ſmall importance, is iven us by [e] Garengeot; namely, that if the wound s in the middle of the abdomen, under the navel, petrating through the rectus muſcle on either ſide, then ne prolapſed part of the inteſtine or omentum is frequently liable to be returned under that muſcle, betwixt s body and the tendinous capſule which very looſely ncompaſſes this muſcle below the navel; ſince it might e thus falſely imagined that the inteſtine is returned nto the abdomen. It is ſufficiently evident, that the ery worſt conſequences muſt follow from ſuch an error;

b Ac, ſi jam ſicciora ſunt inteſtina, perluenda aqua ſunt, cui paululum lmodum olei ſit adjectum. *Ibidem.* c Ibidem.

d Quod medicus priora ſemper inteſtina, quæ poſteriora prolapſa ſunt, ondere debet ſic, ut orbium ſingulorum locum ſervet. Repoſitis ombus, leniter homo concutiendus eſt; quo fit, ut per ſe ſingula inteſtina ſuas ſedes ciucantur, et in his conſidant. *Ibidem, p.* 453.

e Traite des Operations de Chirurgie, Tom. I. p. 102.

ror; namely, inflammation, pain, *&c.* in the inteſtine thus violently compreſſed by the incumbent muſcle.

But when the prolapſed inteſtines are already cold, or dried by the air, it will then be beſt to foment and moiſten them before their reduction: for which purpoſe nothing better can be contrived, than the application of the inteſtines of a healthy living animal, immediately after opening its belly; for then they are warmed and moiſtened in a manner with their natural foment. Hence this method is often the only relief that can be had in the iliac paſſion, and in the reduction of incarcerated ruptures. If living animals are not at hand for this uſe, warm milk and water, with a little oil, or fat mutton-broth boiled with emollient herbs, may be uſed for the ſame purpoſe, if they are applied of a due warmth. It is indeed true, that upon returning the prolapſed and cold inteſtines into the cavity of the abdomen, they will be there warmed and moiſtened: but we ought firſt to be certain, that life ſtill remains in the cold and ſenſeleſs parts, before they are replaced; or elſe we may expect an abſolute mortification, if they have already begun to be gangrenous; and though a ſeparation of the corrupted parts ſhould ſucceed there, the contents of the inteſtines would nevertheleſs eſcape into the cavity of the abdomen, whence the death of the patient would follow, after ſuffering the moſt miſerable diſorders.

§. 316. IF the inteſtine, coming through a ſmall wound of the abdomen, cannot be reduced, either from its inflammation, or its diſtention with wind or fæces; let it be returned by means of fomentations, by puncturing, or by dilating the wound.

When the abdomen is perforated with a large wound, the inteſtines eaſily prolapſe; but then there is alſo no great difficulty in replacing them: but when part of an inteſtine has been forced through a narrow wound, the diſorder is much more dangerous. For the prolapſed inteſtine

ıteſtine being compreſſed by the margin of the wound, ill ſoon be diſtended with flatus, or the ingeſted ali- ıents driven thither by the periſtaltic motion: whence ıe inteſtine will be inflamed, tumefied, and incapable f being returned through the ſtricture of the wound; hence a ſtoppage of the circulation, with a gangrene, oon follow, as hath frequently been obſerved in in- arcerated ruptures. It is very evident, that in this ıſe the inteſtine cannot be reduced, unleſs the diſten- on of it be firſt diminiſhed, or the wound dilated; the ormer of which ought always to be firſt attempted, nce the dilatation of the wound cannot be performed ithout pain and danger. Thoſe fomentations may be ıerefore applied warm, which are directed under the receding aphoriſm; and then it may be gently at- mpted by the hand to propel the flatus, or other con- nts, through the wound, into the common tract of ıe inteſtine, by which means the tumour may ſubſide, ıd the inteſtine be reduced. But if it ſhould continue ſtended with flatus, and fomentations have been uſed r ſome hours without effect, the diſtended part of ıe inteſtine may be then punctured with a needle in veral places, to diſcharge the flatus. Nor is there ıy danger to be feared from theſe ſmall wounds: for ıe flatus being diſcharged, the inteſtine will contract, ıd the ſmall openings made by puncture will diſap- ear; nor will they permit any of the inteſtinal con- nts to eſcape. [a] Parey tell us, that he has ſucceſsfully ed this puncturation of the inteſtine. But to pre- nt the ignorant from blaming or reflecting upon this ethod of perforating the inteſtine, it is beſt to per- rm it privately, as it may be done without difficulty: or the fatal event of ſuch a wound might be ſome- nes aſcribed to the ſurgeon, though he does no more the caſe than what art evidently requires.

But if this method ſhould likewiſe not ſucceed, a di- tation of the wound then only remains; which Celſus [b] s alſo recommended in this caſe, when he ſays, That the wound is narrower than will conveniently per- it the return of the inteſtines, it muſt be ſufficiently enlarged

[a] Livre x. chap. 36. p. 256. [b] Medic. lib. vii. cap. 16.

enlarged by inciſion. But great caution is here evidently required, becauſe the prolapſed inteſtine, being very ſtrictly compreſſed by the wounded lips of the peritonæum and integuments, may therefore be eaſily injured. To avoid this, the ſurgeon introduces a grooved probe or director into the cavity of the abdomen, drawing the inteſtine a little out at the ſame time, when that is found neceſſary; and then, that he may be certain the inteſtine is not intercepted betwixt the director and the margin of the wound, he draws the inteſtine a little more out: he then introduces his inciſion-knife into the groove of the director, and carefully divides the peritonæum: this done, he elevates the director and inciſion-knife lodged in its ſulcus, and divides the integuments of the abdomen, till the opening appears ſufficiently large for the commodious return of the inteſtine into the cavity of the abdomen. But if the ſtricture upon the prolapſed inteſtine is ſo great that it is impoſſible to introduce the director, the inteſtine is to be preſſed with the fleſhy part of the fore-finger, that it may recede a little from the margin of the wound; and then let the integuments and peritonæum be divided a little, upon the nail of the ſame finger, to make way for the introduction of the grooved probe or director.

To perform this operation with the greateſt ſafety, ſeveral uſeful inſtruments have been contrived by celebrated ſurgeons. Thus we are furniſhed with a director, which conceals an inciſion-knife in its groove, that can be raiſed at the pleaſure of the ſurgeon, by preſſing upon a ſpring; the figure of which inſtrument may be ſeen in Heiſter's Surgery [c]. Petit uſed only a ſtreight inciſion-knife, furniſhed with an obtuſe point, and with a very dull edge: this knife he introduced perpendicularly into the abdomen, without danger of injuring the viſcera; becauſe it had a globular point, and would not eaſily cut; yet the edge of the knife was ſharp enough to divide the very tenſe integuments of the abdomen [d]. The ſimplicity of this method has pleaſed many, but there are other ſurgeons who

[c] Inſtitut Chirurg. Part. II. cap. 114. tab. xxiv. p. 797.
[d] Garengeot Traite des Operations de Chirurgie, Tom. I. p. 119.

who prefer the former inſtrument.

The wound being thus dilated, and the prolapſed inteſtine returned, all the reſt is to be conducted in the manner deſcribed at §. 311.

§. 317. IF part of the inteſtinal tube is loſt either by a wound, ſuppuration, or gangrene, and the upper part of the inteſtine offers itſelf, or can be carefully drawn out, it ought then to be ſewed to the margin of the wound.

But if the inteſtine is entirely divided; or if, prolapſing through a narrow wound, and not being returned in time, part of it ſhould be deſtroyed by a ſuppuration or gangrene; in that caſe the continuity of the inteſtinal tube is removed: and if the divided ends are returned into the cavity of the abdomen, it is very evident that the chyle of the inteſtines, being diſcharged into that cavity, accumulated, and there putrefied, muſt produce a train of miſerable conſequences, and inevitable death. The ſame is alſo true, if the inteſtine be returned entire, but invaded in ſome part with a gangrene; for the diſeaſed part muſt then ſeparate, whence all the ſame maladies will follow. All that art can then perform, is, to attach the end of the divided inteſtine to the external margin of the wound; and thus a filthy drain will be there fixed during life, which will ſupply the place of the anus. Phyſicians and ſurgeons formerly had no hopes of this concretion of the divided inteſtine; being oppoſed by the authority of Hippocrates[a], who ſays, That if a ſmall inteſtine be divided, it does not heal or unite. But we are taught by wonderful obſervations, that ſuch a concretion is not always to be deſpaired of. A ſtrong man had been afflicted with a rupture for the ſpace of eight years, which however did not give him much trouble; but on a ſudden the hernia ſwelled with a conſiderable hardneſs, which the ſurgeons in vain attempted to remove by the

[a] Aphoriſm. 24. ſect. 6. Charter. Tom. IX. p. 261. et in Coacis Prænot. nº 503.

application of emollient cataplasms. At length the tumour suppurated; and, being opened, the surgeon amputated part of the intestine, which was putrefied to the length of four fingers breadth: afterwards a portion of the same length separated spotaneously. When it was now believed by every body, that an opening would remain in this place, which would perform the office of an anus during the patient's life; yet, beyond all expectation, the discharge of humours from the wound grew less, and the patient was cured within the space of thirty-three days, and lived afterwards in perfect health[b]. We are still more evidently taught by another case, that an intestine which has been totally divided may unite together. In a man afflicted with a rupture, part of the intestinal tube, to the length of six inches, was destroyed by a gangrene. A thread being passed through that part of the mesentery to which the corrupted intestine adhered, both ends of the intestine were by that means retained in the mouth of the wound, with a view that they might adhere to the margin of the wound, and that the upper end of the intestine might perform the office of an anus, the other end remaining useless: but in a month's time the two ends so united, beyond all expectation, that the ingested aliments were discharged again, by their common course, through the anus; so that the man recovered; only with this inconvenience, that if he eat much, he was troubled with the colic, which began at the part wounded, and grew less upwards. This seems to have been the consequence of a stricture in the intestinal tube, which was not only narrower, but of a more compact substance, and less able to yield, where the two ends were united[c]. This is also confirmed by another remarkable instance. Ramdohrius, surgeon to his Serene Highness the Duke of Brunswick, removed a considerable part of the corrupted intestine, in a woman who had an incarcerated rupture, which broke spontaneously: he afterwards introduced the upper end of the intestine into the lower; and having conjoined them by a slight suture, replaced them into the abdomen.

[b] Academie des Sciences, l'an 1723. Hist. p. 41, &c. [c] Ibid. p. 44.

men. This woman being thus ſnatched from the jaws of death, lived afterwards in health: but being taken with a pleuriſy, ſhe expired in about a year from that time; and upon opening her body, the ends of the inteſtine appeared to have well united together. This inteſtine, together with part of the abdomen to which it adhered, is now kept by the celebrated Heiſter [d], to whom it was given as a preſent by an expert ſurgeon.

But it is very evident, that ſuch an union of the divided inteſtine will not follow if the two ends are left fluctuating in the abdomen. It is required for this purpoſe that they remain in contact with each other, by adhering to ſome adjacent part: and therefore this union more frequently happens in ruptures, becauſe the extremities of the inteſtine, coming through the ring of the abdominal muſcles, folded together, remain in contact with each other, as it is beautifully demonſtrated and illuſtrated with figures by the celebrated Morand [e], who has very rationally deduced the manner of concretion, and the other conſequences thence ariſing, from the ſtructure of the parts. It is in the ſame place proved, that the capacity of the inteſtinal tube is always leſs in the part where it is joined, which the ſame author teſtifies he has frequently ſeen after death in the bodies of thoſe who have been afflicted with theſe diſorders. On this account, therefore, if the patient does not abſtain from the more compact food, and eat in ſmall quantities at a time, there will be danger of an obſtruction at the ſtricture; whence will follow the moſt acute pains, and often a rupture of the part, though long conjoined: of which we have an inſtance in a woman who expired from this cauſe many years after ſhe had been perfectly cured, in whoſe abdomen both the ingeſted aliments and medicines were found diſcharged by a rupture of the inteſtine in that part where its two divided ends had united [f].

But when there are no hopes that the divided ends of the inteſtinal tube can be united with each other, the only method that then remains, is, to conjoin the up-

[d] Inſtitut. Chirurg. Part. II. cap. 117. p. 818. [e] Acad. des Sciences, l'an 1735. Mem. p. 335, &c. [f] Ibid. p. 343.

per end of the inteſtine by ſuture to the margin of the external wound; where it ſometimes naturally tends, or is cautiouſly conducted by art, to ſerve as an artificial anus during life; while the other end, being tied with a ligature to prevent its preſent contents from eſcaping into the abdomen, remains ever afterward uſeleſs. And in this manner may life be preſerved if the length of the inteſtinal tube from the pylorus to the artificial anus be ſufficient to abſorb chyle enough from the ingeſted aliments to ſupply the blood for repairing thoſe loſſes which are made in the ſubſtance of the body by the continual actions of life. But in order to know which of the two extremities belongs to the upper tract of the inteſtines continued to the duodenum, take the ſigns delivered by the celebrated Littre [g]. The upper extremity will have an apparent vermicular motion: The matter of the chyle will paſs alternately through that extremity; the ſides of which will not appear entirely collapſed; or if they do ſometimes collapſe, they will be ſoon after elevated by the matter contained in the cavity of the inteſtine protruded there. But in the other end of the divided inteſtine, which is continued to the rectum, there will be no periſtaltic motion, nor any thing diſcharged from thence, unleſs in the beginning, or when ſomething is forced out by a convulſive and retrograde motion aſcending from below; and which never follows ſo regularly, as it may be diſcerned to do in the upper extremity. That extremity being found which is continued to the duodenum, the ſurgeon divides its circumference in three places, and unites it by ſuture to the margin of the wound; or elſe, by paſſing threads through the end of the inteſtine, retains it in the mouth of the wound till it there conjoins. Thus may life be preſerved by art; but not without a very foul inconvenience, ſince the fæces muſt paſs this way ſo long as the perſon lives. It ſometimes happens, that the upper extremity of the divided inteſtine conjoins with the mouth of the wound by the aſſiſtance of nature only. Thus M. Mery [h] cut off above

[g] Acad. des Sciences, l'an 1700. Mem. p. 394. [h] Ibid. l'an 1701. p. 372, 373.

bove five feet in length of a mortified inteſtine in a maid of twenty-eight years old, following an incarcerated rupture; and the upper orifice of the inteſtine adhered afterwards to the inguen, where the fæces were diſcharged during the remainder of life; and they were ſufficiently hard and figured, when ſhe took food of eaſy digeſtion and in moderate quantities. Many ſuch caſes have happened after a battle, when ſoldiers ruſh upon the enemy with their bayonets fixed upon their muſkets, whence frequently follow very bad wounds of the abdomen, attended with a diviſion of the inteſtines. I remember to have ſeen a ſoldier about twenty years ago, in whom the inteſtinum colon adhered to the external orifice of the wound after it had been divided in this manner; and as he begged alms, he readily permitted the inteſtine to be examined; which adhered with ſome part of it hanging out, ſo that one might very well examine the ſurface of the inteſtine. It was then ten years ſince he had received the wound, and he ſeemed to enjoy a perfect ſtate of health.

§. 318. IF the omentum is prolapſed, and appears as yet moiſt, warm, and reddiſh with the circulating blood, is to be replaced as before (316).

Hippocrates ſays [a], That if the omentum prolapſes through a wound, it muſt neceſſarily corrupt or mortify. Certain it is, that the tender fabric of the omentum cannot be long expoſed to the cold of the external air, without a conſiderable injury of the vital circulation of its juices, which is ſometimes totally deſtroyed by the ſame means; and therefore it ought to be replaced immediately, if it is poſſible. But it muſt be obſerved, that the membrane of the omentum is ſo thin, that it will not bear to be roughly handled without laceration: the greateſt circumſpection therefore muſt be uſed in replacing it; for otherwiſe, by breaking the ſmall veſſels of the omentum in a rough reduc-

[a] Aphoriſm. 58. ſect. 6. Charter. Tom. IX. p. 289.

tion of it, the conſequences may be inflammation, ſuppuration, a gangrene, and a train of the worſt maladies. For this reaſon the wound ought rather to be dilated, that the omentum may be replaced without violence. The moiſture, warmth, and red blood, viſible in the ſmall veſſels of the omentum, denote that the vital motion of the juices ſtill continues in the part which is prolapſed through the wound.

§. 319. BUT if the omentum appears dry, cold, or livid, it is to be firſt treated with fomentations, or elſe the mortified part removed by ligature and inciſion, before it is replaced.

But when the omentum has lain a conſiderable time out of the wound, it uſually mortifies, and that in a very ſhort time; which may be known from its coldneſs, dryneſs, and livid or black colour. It would be dangerous to return a part thus mortified into the abdomen; for by its ſeparating afterwards from the living parts, it would putrefy in that cavity, and infect all the adjacent viſcera. Upon this account Celſus adviſes to conſider the ſtate of the omentum after the inteſtines have been returned into the abdomen: *That if any part of it is already black or mortified, it muſt be cut off with a pair of ſciſſars; and if any remains ſound, it may be gently returned over the inteſtines* [a]. But if, notwithſtanding the change of colour, there remain ſome hopes that the life of the part may be recovered, let it be treated with emollient fomentations, and eſpecially by the application of live animals ſlit open; and when the ſigns of life again appear, to wit, moiſture, warmth, and rednefs of colour, it is then to be returned into the cavity of the abdomen, or elſe what is mortified muſt be cut off. There are, however, ſome celebrated ſurgeons, who return the omentum if it only appears livid in a ſmall degree; and they affirm that no bad conſequences have followed from thence, for then

a Ex quo, ſi quid jam nigri et emortui eſt, forfice excidi debet; ſi quid integrum eſt, leniter ſuper inteſtina reduci. *Lib.* vii. *cap.* 16. *p.* 453.

then life eaſily returns into this part by the natural heat of the body[b]. But when the mortified part of the omentum is to be extirpated, a thread is firſt paſſed round the ſound part, and then tied, for cutting off what is mortified under the ligature, at about the diſtance of a finger's breadth from it; the remainder is then returned into the abdomen, taking care that a ſufficient length of the thread may hang out of the wound, that it may be conveniently extracted after the ſeparation is made. Nor has any great inconvenience been obſerved to follow after a part of the omentum has been thus extirpated. Galen[c] indeed tells us, that a part of the omentum being loſt, renders the ſtomach colder and leſs apt to make a good digeſtion; and affirms, that he has ſeen a certain gladiator, who had loſt almoſt the whole omentum by a wound, and was afterwards obliged continually to wrap up his abdomen with flannels to avoid injury from the external cold. But it is evident from numberleſs obſervations ſince made, that this accident has not followed a loſs of the omentum[d]. Upon this account it would ſeem, that it may be ſafely extirpated: which is alſo confirmed by obſervations upon dead bodies, in which a great part of the omentum is often found wanting, notwithſtanding the functions of the abdominal viſcera have been duly performed in thoſe perſons.

§. 320. PLentiful bleeding, with the injection of clyſters in the beginning when the large inteſtines are unhurt, a proper regimen of diet, a quiet reſpiration, with reſt, and a proper poſture of the body, are here the principal remedies.

From what has been hitherto related, ſeveral general methods of relief are deduced, which have been always found highly ſerviceable in the moſt dangerous wounds of the abdomen. Such are,

Bleeding.]

[b] Dionis Cours d'Operations de Chirurgie, demonſt. 2. p. 73. Garengeot Traite des Operations de Chirurgie, Tom. I. p. 120. [c] De Uſu Part. lib. iv. cap. 9. Charter. Tom. IV. p. 377. [d] Acad. des Sciences, l'an 1725. Hiſt. p. 13.

Bleeding.] Nothing is here more to be feared than an inflammation of the abdominal viſcera; which ſpeedily tending to a gangrene, after the moſt excruciating pains, often kills the patient in a very little time. Now the beſt remedy againſt this is plentiful bleeding; which uſually removes the preſent inflammation, and prevents the future. Thus in the incarcerated rupture ſcarce any remedy ſucceeds, unleſs the ſtrength be weakened by a very bold repetition of phlebotomy, ſo as to reſtrain the too great impetuoſity and inflammatory motion of the vital powers.

Clyſters, *&c.*] If the large inteſtines are hurt, it is very evident that clyſters will be pernicious by eſcaping into the cavity of the abdomen: but if they appear to be entire, then clyſters will be extremely ſerviceable, by diſcharging the hard fæces of the large inteſtines, that the patient may not be afterwards obliged to ſtrain violently upon the ſtool for their expulſion. For in evacuating the bowels, the diaphragm is preſſed downward by the inſpired and retained air; and the abdominal muſcles acting at the ſame time, very ſtrongly compreſs all the parts contained in the abdomen, which will therefore preſs upon the part wounded, ſo as either to force out the omentum or inteſtines, or elſe lacerate or break open again that which lately began to heal: whence the uſefulneſs of clyſters in wounds in the abdomen is ſufficiently evident.

Diet.] It was ſaid before, under the cure of wounds in general, in §. 192, that thoſe aliments are chiefly ſerviceable, which are of a mild nature, and eaſily digeſted or aſſimilated, without being apt to putrefy, provided they are taken often and in ſmall quantities at a time. But in wounds of the abdomen it muſt be alſo conſidered, that the action of thoſe viſcera is often injured, which ought to have the greateſt ſhare in changing the crude aliments ſo effectually as that they may be afterwards capable of forming part of ourſelves by the action of the lungs and veſſels; at the ſame time alſo it muſt be obſerved, that a large quantity of aliments taken at once will immediately diſtend the ſtomach and inteſtines; whence it is evident, that great caution is required

required in managing the diet. But it will be alſo of the greateſt uſe here to give ſuch aliment as leaves the leaſt quantity of groſs fæces in the inteſtines; ſince ſtraining upon the ſtool, after all the fæces have been firſt diſcharged by a clyſter, ought to be avoided as much as poſſible. All theſe intentions are anſwered by nothing better than the uſe of broths made of the fleſh of young animals: for if three or four ounces of them be taken every two hours, mixed with a little citron-juice to prevent them from degenerating too eaſily into a putrid ſtate, life will then be ſupported with little or no action of the ſtomach and inteſtines to change theſe aliments; and at the ſame time very few or no fæces will be collected in the inteſtines, ſo that the patient may remain without going to ſtool ſeveral days, or even weeks, without detriment. Toaſted bread may be ſoaked or boiled in theſe broths; but muſt be afterwards taken out, to avoid increaſing the quantity of fæces in the large inteſtines. As for drink, mere water, with the addition of a little wine, will be ſufficient; but a decoction of bread, barley, or oats, or even ſoft ale, may be ſometimes allowed. Milk, if not its whey, is to be here avoided; becauſe it leaves too large a quantity of groſs fæces, as we ſee evidently in infants, who frequently diſcharge very thick and groſs fæces, though they only ſuck the milk of their mother.

Quiet reſpiration, reſt, and a proper poſture of the body.] For at every inſpiration the abdominal muſcles are diſtended, and contracted again at the time of exſpiration, by which means the contents of the abdomen will be alternately compreſſed: therefore the quieter the reſpiration, the leſs will the wounded parts be agitated, and the more eaſily united. For the ſame reaſon, too, reſt is here very neceſſary; but the poſture ought to be that in which the patient may remain with the moſt eaſe, namely, with the body placed a little erect upon a couch, nearly in a ſitting poſture, with the orifice of the wound inclined as much as convenience will permit, that the blood, matter, and other humours, may have a ready diſcharge, without being collected in the cavity of the abdomen.

Theſe

Theſe are the means proper to be uſed in all wounds of the abdomen; as alſo after cutting for the ſtone, or a fiſtula of the anus: for unleſs the patient be prevented from ſtraining upon the ſtool in thoſe diſorders, the very worſt conſequences may follow, though the operation has been happily performed. It is alſo evident from obſervations, that the moſt deſperate wounds of the abdomen, attended with the worſt ſymptoms, have been happily cured by this method. It will be ſufficient for us at preſent to produce only one inſtance, which we mentioned once before upon another occaſion in the commentary on §. 170, n° 5. A madman inflicted eighteen wounds in his abdomen, eight of which penetrated its cavity, and injured the contained viſcera. The violent fever, tenſion of the abdomen, difficult and painful reſpiration, nauſea, vomiting, diarrhœa, *&c.* afforded a ſevere prognoſis, inſomuch that he was almoſt given over. Phlebotomy was repeated ſeven times in the four firſt days; the diet was very thin, compoſed almoſt entirely of fleſh-broths, with the addition of lettuce, ſuccory, purſlain, and the like mild pot-herbs; perfect reſt was procured with lenient and diacodiate emulſions; and by a careful and ſeldom dreſſing of the wounds, with thoſe means, the patient not only recovered from ſo many wounds, but became perfectly well both in body and mind. Seventeen months after this, he became mad again; and threw himſelf from a high precipice, by which he was inſtantly killed: On opening the body, the cicatrices which appeared, demonſtrated, that the middle lobe of the liver had been wounded, as alſo the inteſtinum jejunum and the colon[a]. This hiſtory demonſtrates how much we may expect from this method in the moſt dangerous caſes.

Of CONTUSIONS.

§. 321. IF a hard and obtuſe body does by its motion, reſiſtance, biting, or preſſure, break

[a] Acad. des Sciences, l'an 1705. Mem. p. 40, &c.

break or lacerate many ſmall veſſels at the ſame time, that injury is termed a Contuſion.

A *Contuſion* is, A ſolution of continuity made in any part of the body by a hard inſtrument, whoſe ſurface does not terminate either in a point or edge, but in ſome obtuſe figure; for by this it is diſtinguiſhed from a *wound*, which is a ſolution of continuity made by a wounding or ſharp inſtrument. Hence a contuſion is always (*cæteris paribus*) larger, or occupies a greater ſpace, than a wound, becauſe the contuſing inſtrument is applied to a larger ſurface of the body. It now, therefore, is very evident, that the effect will be the ſame, whether the obtuſe body in motion ſtrike upon a part of the human body, or whether a part of the human body in motion be forced againſt a hard obtuſe and quieſcent obſtacle, or whether the obtuſe body preſſes upon the part by its own weight, or by pinching cruſhes any part.

§. 322. THE idea of which is an aſſemblage of little wounds, with a cruſhing of the ſolid fibres and veſſels.

There may be ſo many ſmall wounds conceived in the contuſion as there are injured parts within its circumference, ſo that an aſſemblage of ſmall wounds cloſe to each other gives the whole idea of a contuſion. Thus for example, if an artery be divided by a razor, it is a *wound;* but if it is divided by an infinite number of inciſions very cloſe to each other, it will in a manner repreſent a *contuſion* of ſuch an artery. But the more ſolid, hard, and reſiſting parts, are uſually broken or ground into very ſmall fragments: As for example, when the bones of the arm are by any cauſe broken in two, it is termed a *fracture;* but if they are cruſhed into ſmall fragments, it is denominated a *contuſion*.

§. 323. THE effects therefore are, A ſolution of continuity with laceration; a deſtructive

ſtructive cruſhing of many fibres and veſſels at the ſame time; an extravaſation of the juices into the adjacent vacuities, which are either there naturally ſeated, or made by the accident; with an infinite number of maladies which may follow from thence. A mortal emphyſema, following a fracture and contuſion of the ribs, may be ſeen in Mem. Acad. R. l'an 1713. p. 119.

A ſolution of continuity with laceration.] A laceration is when the ſoft parts of the body are ruptured by diſtracting: and this diſtraction being preſent in all contuſions, diſtinguiſhes them from wounds; in which there is alſo a ſolution of the continuity, but without that laceration, ſince a wound is inflicted by a ſharp inſtrument. A wound may indeed be joined with contuſion, but then it is a compound diſorder.

A deſtructive cruſhing, *&c.*] A wound being attended with a ſimple diviſion only of the parts which before cohered, gives an opportunity, frequently, for a happy cure, even in the largeſt wounds, by a concretion of the divided parts brought again into contact. But, in a contuſion, the parts are ſo ground to pieces, that, their vital fabric being deſtroyed, it is impoſſible for them to unite again with the parts adjacent: and this makes a ſeparation of them all neceſſary in order to a cure; becauſe, being deprived of all the vital influx of their juices, they are now dead, and are to be conſidered as foreign bodies interpoſed betwixt the living parts, which are thereby prevented from uniting with each other. Hence Hippocrates juſtly pronounces, That contuſed fleſh being converted into matter, muſt neceſſarily be deſtroyed or waſted[a]: Therefore he would have a ſuppuration to be ſpeedily procured in this caſe.

An extravaſation of the juices into the adjacent vacuities, *&c.*] The veſſels being ruptured, their contained juices are then extravaſated and depoſited in foreign parts. Even Hippocrates has been bold enough to pronounce, that the whole body is full of cavities: *For all that*

[a] De Ulceribus, cap. 2. Charter. Tom. XII. p. 131.

that is not concreted or ſolid is hollow, whether it be covered with fleſh or ſkin. The cavity is indeed filled with air in a healthy ſtate, but in a diſeaſed ſtate with ichor [b]. Therefore the extravaſated humours will every where find a paſſage into theſe ſmaller or larger cavities of the body. For there is ſcarce any veſſel, muſcle, tendon, or even fibre, in the whole body, but what is inveſted with a membrane very eaſily dilatable, and compoſed of many cells communicating with each other: the ſmall cells or cavities therefore of this membrane are diſperſed through every part of the body, and may be filled with the juices extravaſated from the ruptured veſſels. As for the larger cavities of the body, ſuch as the ventricles of the brain, the cavity of the thorax, of the veſicles, trachea, and bronchia of the lungs, with the cavity of the pericardium, abdomen, ſtomach, *&c.* theſe are ſufficiently known. But the extravaſated humours may not only fill theſe larger or ſmaller cavities, which are naturally in the body; but they may be alſo there accumulated, and, by diſtending or removing the parts which were before contiguous, they may either make new cavities, or elſe greatly increaſe the magnitude of the natural cavities: As for example, after a violent contuſion of the head, the veſſels of the dura mater being ruptured, the blood extravaſated and collected betwixt that membrane and the ſkull, may ſeparate the dura mater from the cranium, to which it before ſtrictly adhered; and thus will a new cavity be formed, which was not there before.

With an infinite number of maladies, *&c.*] All the maladies which follow from contuſion are reducible to three heads: For they either ariſe from a rupture of the ſolids, and an extravaſation of the fluids, which deſtroy the functions reſulting from the determinate motion of the juices through the entire veſſels; or elſe they follow from the preſſure of the extravaſated humours, collected in ſome natural or preternatural cavity of the body, and by their weight or bulk diſturb-

[b] Omne enim non concretum, ſive cute, ſive carne tegatur, cavum eſt. Impletur autem ſanum quidem ſpiritu, ægrotum vero ichore. *De Arte*, cap. 8. *Charter. Tom. II. p.* 150.

ing or abolishing the functions of the adjacent parts; or, lastly, they follow from the putrefaction of the stagnating and extravasated juices, which may acquire an acrimony sufficient to corrode and destroy the circumjacent parts. If now these three circumstances are applied to every particular part of the body, it is evident, that an infinite number of maladies may thence follow, which it would be impossible to enumerate, and therefore it is sufficient for me to have pointed out their general sources. The instance which is here referred to in the Memoirs of the Royal Academy teaches us, that violent contusions may be frequently attended with surprising symptoms, not easy to be foreseen by the most skilful in the profession. A man of sixty years of age had his ribs fractured and contused by the wheels of a chariot running over his breast, so that a fragment of a rib slightly wounded the external membrane of the lungs, whence part of the inspired air escaping by the wound into the cavity of the thorax, insinuated itself into the cellular membrane, and inflated almost the whole surface of the body with a surprising emphysema, insomuch that the miserable patient was suffocated on the fourth day after the accident. [c] Parey has formerly observed such a flatulent tumour formed about the ribs after contusions; but he does not seem to have well understood the cause. There are many other instances to be met with in the writers of observations, which teach, that a violent contusion has frequently wounded or separated the liver, spleen, *&c.* without any apparent injury in the external parts; whence sudden death. Even sometimes a violent contusion has been observed to produce sudden death, though no considerable injury could be observed either in the external or internal parts. See what has been said upon this subject, in the commentary on §. 274. A remarkable case of this nature is related in Bohnius [d], of a man who was struck by a stone of several pounds weight, which was violently flung against the right hypogastrium, whereupon he suddenly fell down and expired. When Bohnius examined the dead body

[c] Liv. xii. chap. 6. p. 293. [d] De Renunciatione Vulnerum, p. 17.

body by order of the magiſtrate, he found no injury either in the integuments, viſcera, or veſſels; only the diaphragm was a little contuſed and livid in that part of the ſame ſide where it is contiguous to the falſe ribs, but the whole compaſs of the bruiſe was ſcarce equal to half a crown.

§. 324. BUT the worſt of theſe caſes (323) is when the internal parts are ſo injured (321, 322, 323), the integuments remaining entire, that the juices ſtagnate, congeal, or putrefy: whence an ecchymoſis; a ſpurious aneuriſm; a black or blue ſpot; an ulcer; gangrene, or mortification; and in the glands, a ſcirrhus or cancer.

The ſkin being tough and very coheſive, is not ſo eaſily ruptured by an obtuſe inſtrument; but the veſſels running through the panniculus adipoſus, placed under the ſkin, are much more tender and more eaſily broken. Thus if any one ſhould receive a blow with a hammer upon the finger, the ſkin will generally remain whole, but yet a black ſpot will deform the contuſed part by an extravaſation of the blood from the ruptured veſſels under the entire ſkin: and this more eſpecially happens if the ſubcutaneous veſſels are forced by the contuſing body againſt any ſubjacent hard bone; for which reaſon it is, that ſuch large tumours ſo ſuddenly ariſe, when the head is ſtruck againſt ſome hard obſtacle. Now the juices thus extravaſated from the ruptured veſſels, and confined by the entire ſkin, are collected in the cellular membrane, where they ſtagnate, and therefore congeal; and where they may at length putrefy, though but ſlowly, if no acceſs be given to the external air. Various bad conſequences may from hence ariſe, the principal of which may be referred to thoſe that follow.

Ecchymoſis.] This is an extravaſation of the juices from their veſſels under the integuments, a definition of which is given us by Ægineta: *The fleſh being contuſed by the ſtroke of ſome heavy body, and the ſmall veſſels therein*

therein ruptured, their blood is then extravaſated per diapædeſin, *and, being collected under the ſkin, forms what is called an* ecchymoſis. *Thus the ſkin not being divided, a ſoft tumour is formed, which yields to the touch, is generally livid, and without pain* [a]. And thus Galen [b] ſays, That an ecchymoſis is when the blood is extravaſated from the veſſels into the circumjacent ſpaces; and in another place [c], That when the contuſed fleſh extravaſates its blood in a part under the ſkin, the diſorder is termed (ἐκχυμωμα) a *ſuffuſion*.

A ſpurious aneuriſm:] That is, when a large artery being hurt, diſcharges a conſiderable quantity of blood into the panniculus adipoſus, where it is collected under the ſkin; concerning which, ſee the commentary on §. 178. So that when the ſmaller veſſels, being ruptured, extravaſate but a ſmall quantity of blood under the ſkin which remains entire, the diſorder is then termed an *ecchymoſis*; but when the ſkin is diſtended with extravaſated blood from the rupture of a conſiderable veſſel, it is termed a *ſpurious aneuriſm*.

A black or livid ſpot.] When the preſſure of the atmoſphere on the ſurface of the body is either diminiſhed, or wholly removed from any part, either by ſucking, the application of cupping-glaſſes, or the like; the blood then ruſhes into the veſſels of the part leſs preſſed, and diſtends them, ſo as to enter many of the ſmaller dilated veſſels, which did not naturally contain any red blood; and the red parts being impacted in theſe veſſels without being able to return, give the appearance of a red, livid, or often of a blackiſh ſpot. Such a ſpot being formed in any part by ſuction, the part is ſaid to be *blood-ſhotten*; but when a part, being ſtruck with a hammer, has its blood-veſſels ſuddenly compreſſed by the ſtroke, then alſo the blood may be forced into the lymphatic or ſerous veſſels, and by changing

[a] Carne contuſa a quodam gravi illapſo, et parvis in illa venulis divulſis ſanguis profunditur per diapædeſin: qui, ubi colligitur ſub cute, facit illud, quod vocatur ecchymoma. Non divulſa cute ſic ut tumor mollis tactui cedens ſequatur, lividus et indolens ut plurimum. *Lib.* iv. *cap.* 30. *p.* 66. *verſa.*

[b] In Commentar. in Aphor. 20. ſect. 6. Charter. Tom. IX. p. 259.

[c] Commentar. 3. in librum Hippocrat. de Medici Officina, text. 31. Charter. Tom. XII. p. 98.

ging their colour may produce a very conſiderable ſpot of this kind. *Blood-ſhot*, therefore, differs from an *ecchymoſis*, in as much as the blood is ſtrongly preſſed into the ſerous veſſels without any rupture in the former; but in an ecchymoſis, the veſſels being ruptured, the blood is extravaſated into the adjacent ſpaces; whence the former of theſe takes place rather about the circumference, than in the middle, of the contuſed part. But it is very evident, that *blood-ſhot* and *ecchymoſis* may both of them follow after violent contuſions, whence they are frequently confounded by authors without diſtinction.

Ulcer and gangrene:] That is, when the extravaſated humours corrupt by ſtagnating, and inflame or erode the adjacent parts. Even ſometimes the circulation is ſtopt by too great a diſtenſion of the cellular membrane with the extravaſated juices, whence a gangrene and mortification may follow.

Caries:] That is, when the forementioned injuries extend to the ſubſtance of a bone.

In the glands a ſcirrhus or cancer.] Since it appears from anatomy, that the glands are compoſed of innumerable ſmall arteries, by the different diſpoſition of which a thin juice is ſeparated from the arterial blood, and, being collected, is afterwards diſcharged by an excretory duct; it is therefore evident, that a contuſion of the glands may ſo injure their ſmall veſſels, and compreſs or obſtruct their emiſſaries, as to deny a free paſſage to the humours ſeparated by the arterial fabric: whence, by a ſtagnation, and by the more fluid parts of the juices being either exhaled or elſe abſorbed by the ſmall veins, an inſpiſſation of the ſecreted juices follows, and forms a hard, indolent, and almoſt irreſolvable tumour, which we call a *ſcirrhus*; which ſcirrhus becoming inveterate, extremely hard, knotty, and accompanied with pain, is then termed a *cancer*.

§. 325. A Contuſion alſo frequently injures the bones; and then follow all the ſymptoms before deſcribed (249, 250, 251, 254, 256, 257), with a depravation of the medulla: whence

ulcers, fiſtulæ, caries, and putrefactions within the bones; for the medulla in the bones will be thence affected like the brain in the ſkull, as at (273, 274).

When a contuſion has extended itſelf into a bone, it may compreſs or rupture the veſſels which run betwixt the component lamellæ of its ſubſtance: whence the vital circulation of the juices in the lamellæ is deſtroyed; and they, therefore, mortifying, muſt be exfoliated, or caſt off from the ſubjacent living parts of the bone. But this diſorder may by degrees ſpread itſelf through the whole ſubſtance of the bone, in the manner explained before under the aphoriſms here cited, treating of the ſeveral injuries of the bones of the ſkull.

A depravation of the medulla, *&c.*] This is an accident the moſt of all to be feared in contuſions of the bones; for the marrow is lodged within the cavities of the larger bones, and there is a like ſubſtance interſperſed betwixt the cells or ſpongy parts of the bones. But as the brain is defended with a boney covering, ſo the medulla lies ſecured within the cavity of the bone: and as the brain is covered with a peculiar membrane, called the *pia mater*, which receives and diſtributes the veſſels entering its ſubſtance; in like manner is the medulla inveſted with a fine vaſcular membrane, for the ſame uſes. The arteries of the pia mater, having depoſited their thicker coats, appear very thin; and the ſame is alſo true in the arteries which are extended to the ſubſtance of the medulla; ſo that the marrow taken out of the thigh-bone of an old ox may be eaſily preſſed into a mere oil betwixt the fingers, notwithſtanding it appears to be furniſhed with innumerable arteries. Alſo, as a fiſſure, fracture, or contuſion of the ſkull, may communicate its diſorders by the corrupted or extravaſated humours, ſo as to infect the brain itſelf; ſo likewiſe an injury in a bone may be extended to its medulla. A violent concuſſion of the head may rupture many of the ſmall veſſels of the encephalon, while the ſkull remains entire; and it is very evident that the ſame may alſo happen to the medulla,

dulla, if a bone which contains marrow is violently ſtruck by a blow. Now when the tender veſſels of the medulla receive the diſorder from the inveſting bone, or are injured by any other cauſe, the medullary oil, extravaſated from the ruptured veſſels, ſtagnates; and thereby acquires a moſt malignant and rancid acrimony, ſo as to erode all that it touches, and render the bone itſelf carious: whence follow moſt malignant incurable ulcers, with obſtinate fiſtulæ, not to be cured, unleſs the parts can be cleanſed from the corrupted medulla. From this malignant eroſion by the putrid oil, follows a deſtruction of the parts, with an infinite number of other diſorders, of which we ſhall treat hereafter, in the diſeaſes of the bones, at §. 526.

§. 326. AND ſometimes the muſcles are alſo injured in like manner by contuſions; whence large abſceſſes or ſuppurations, gangrene, palſies, or a ſtiffneſs or contraction: but if the contuſion deſtroys large nerves which diſtribute many branches, it then certainly produces a palſy, a withering, inſenſibility, or a gangrene of the parts below, not to be cured by any art; and this is more eſpecially true of the ſpina dorſi, and its contained medulla.

Muſcles.] It appears from the modern anatomy, that any viſible muſcle may be divided into ſmaller bundles of muſcular fibres: nor have we hitherto been able to find out the extent of this diviſion, even though aſſiſted by microſcopes; for no one has been ever yet able to ſee a ſingle muſcular fibre, but always ſeveral fibres appear collected together. Theſe faſciculi of muſcular fibres are inveſted with a thin cellular membrane, which contains a ſubtile oil for lubricating thoſe fibres. But the ſmall arteries are very numerouſly diſperſed betwixt the interſtices of thoſe faſciculi, within the cellular membrane, as the injections of Ruyſch demonſtrate, inſomuch that they ſeem to conſtitute almoſt the whole ſubſtance of the muſcle. Theſe arteries are likewiſe accompanied with ſimilar ſmall veins, as alſo with nerves,

nerves, throughout the whole ſubſtance of the muſcle. A contuſion of a muſcle may therefore break theſe veſſels, and extravaſate their juices in the cavities of the cellular membrane; where being collected, they may compreſs the adjacent veſſels. The extravaſated juices may be alſo corrupted, and by their acquired acrimony may corrode the parts within their contact; whence inflammation, ſuppuration, gangrene, *&c.* But ſuppurations ariſing from this cauſe are the worſt of any, becauſe the matter formed in the thin cellular membrane, which inveſts the muſcular fibres, will make itſelf ſurpriſing paſſages, ſo as to run through all the tracts of this membrane, forming fiſtulæ and ſinuſes of the worſt kind. Add to this, that the cellular membrane being conſumed by a long ſuppuration, may give occaſion for the faſciculi of muſcular fibres, which it diſtinguiſhed from each other, to grow afterwards together: whence the free motion of thoſe fibres, ariſing from their diſtenſion by thoſe cauſes which move the muſcle, will be impeded; by which means the action of the muſcle itſelf will be either depraved, or totally deſtroyed. Even the muſcular fibres themſelves, ſtrictly ſo called, may be deſtroyed by a violent contuſion: whence the muſcular motion, which depended upon the continuity of theſe fibres, will ceaſe; and then enſues a paralyſis of the muſcle, *i. e.* an inability to motion, accompanied with a flexibility and laxneſs. But alſo a contraction of the limb may from thence follow, when the cellular membrane, which diſtinguiſhes the muſcular fibres, being deſtroyed by a violent ſuppuration, occaſions the fibres to grow to each other, ſo as to intercept the influx of their thinneſt juices; whence a gradual contraction or ſhrinking of the muſcle, which can be no more elongated by any diſtracting power; and from thence may ariſe ſurpriſing contractions, or diſtortions of the limbs; which may alſo proceed from the action of any muſcle being deſtroyed, while the action of its antagoniſt prevailing, continually draws the limb towards its origin, where it at length ſtiffens: hence it is that a contraction of a limb ſo frequently follows an inveterate palſy.

But

But when muſcular fibres are ruptured by a contuſion, without deſtroying the action of the muſcle, it ſeems then to produce that very painful diſorder which the ancient phyſicians called (σπασμα) a *pulling*, or (ρηγμα) a *rupture*. Galen, treating of a contuſion, ſays, *But it is manifeſt, that the ſmall veſſels are divided together with the fleſh, in the formation of* contuſions (εκχυμωματων). *But* diſtractions (σπασματα) *are made upon the fibres of the muſcles which are moſt diſtended, ſo that ſome of them are broken; which diſorder is properly called by ſome of the younger phyſicians* (ρηγματα) ruptures. *But among theſe Hippocrates is the firſt that remarks*, &c [a]. Theſe ruptures are thus deſcribed by Hippocrates: *But ſome people having a weak diſtenſion in the fleſh or ſmall veſſels, a ſuppuration does not follow; but laſting pains are produced, which are called* (ρηγματα) ruptures [b]. And in the end of the ſame chapter he adds, *For diſtractions ariſe from hard labour, from accidents, and from wounds, or when a perſon lifts too great a weight; as alſo from running, wreſtling, and all ſuch like motions* [c]. He ſeems alſo to have ſpoken of this in his Prænotiones Coacæ, where he ſays, *That all diſtractions are uneaſy, and at firſt produce intenſe pains, giving afterwards but ſlight uneaſineſs; but are very obſtinate and the moſt dangerous about the thorax* [d]. But it muſt be obſerved, that in the tranſlation they have rendered (σπασματα), *convulſiones*, improperly; ſince theſe are called (σπασμοι). But Galen [e] obſerves to us, that the muſcular fibres thus divided are very difficultly conjoined again: for it was his opinion, that

[a] Manifeſtum autem, quod parvæ venæ una cum carne dividuntur in ſuffuſionem (εκχυμωματων) generatione. Vulſiones (σπασμαλα) autem fiunt circa fibras muſculorum amplius diſtentas, ut nonnullæ rumpantur, et vocant proprie juniores medici hos affectus rupturas (ρηγμαλα). Horum autem primus Hippocrates meminit, &c. *Commentar.* 3. *in librum Hippocrat. de Medici Officina, text.* 31. *Charter. Tom. XII. p.* 98.

[b] Quibuſdam autem, cum imbecilles in carnibus aut venis vulſiones factæ fuerint, non ſuppurantur, ſed diuturni fiunt dolores, et vocant ruptiones (ρηγματα). *De morbis, lib.* i. *cap.* 8. *Charter. Tom. VII p.* 541, 542.

[c] Fiunt enim vulſiones a laboribus, et caſibus, et a plaga, et ſi quis onus majus tollat, et a curribus, et luctæ et ejuſmodi omnibus. *Ibid.*

[d] Vulſiones omnes quidem moleſtæ fiunt, et dolores in initio intenſos producunt, et in poſterum aliquos commonefaciunt, difficiliſimæ autem circa thoracem et maxime periculoſæ. N° 425. *Charter. Tom. VIII. p.* 877.

[e] Method Medendi, lib. iv. cap. ult. Charter. Tom. X. p. 102.

that the ruptured fibres would eaſily enough unite, the ecchymoſis was ſpeedily diſperſed; but when th continued a long time, then the foul humours collecte betwixt the ruptured fibres obſtructed their union; that from the great fatigue, fever, and leſs perfect d geſtion of the aliments, with ſuch like cauſes, the pa returned again. Perhaps there may be ſomething this nature in the muſcles after violent ſtraining, i lifting up great weights, *&c.* For ſevere and ſudde pains then ariſe, which frequently torment the patie for a long time, and are exaſperated by the leaſt mo tion of body. Certain it is from experience, that a abſolute reſt of body is the chief remedy in theſe pain. Hence Hippocrates [f] directs, for the cure of theſe rup tures or diſtractions of the muſcular fibres in the tho rax, that the patient abſtain a year from labour: and i another place [g], after ſaying that this diſorder ariſe from immoderate labour, he obſerves, that reſt of bod is highly neceſſary; otherwiſe the diſeaſe will return and torment the patient worſe than at firſt.

But if large nerves, *&c.*] If we conſider the nerve in their origin, at the medulla oblongata and ſpinalis they evidently appear very ſoft; and if the extremitie of the nerves be alſo conſidered, in thoſe parts wher they depoſite their integuments to form a ſenſitive or gan for conveying ideas to the mind by the new change or impreſſions made upon them by external objects, hov tender do they there appear! This is evidently demon ſtrated by the pulp of the auditory nerve, and in th retina of the eye, which laſt immediately collapſes int a ſhapeleſs mucus, if it is not ſuſtained by the equal preſ ſure of the ambient humour. But theſe tender ner vous threads are ſafely conveyed from their origin, t the extreme parts of the body, under the defence o tough coats and integuments. If therefore a large nerv ſhould be contuſed in its courſe, the ſoft pulp-like ſub ſtance of it may be injured, or even deſtroyed, while tho integuments of the nerve appear uninjured; from whence all thoſe functions will be deſtroyed, which reſulte from

[f] De Morbis, lib. ii. cap. 24. Charter. Tom. VII. p. 576.
[g] De Internis Affectionibus, cap. 9. Charter. Tom. VII. p. 644.

from the ſound ſtructure of the ſeveral ſmaller nerves collected together in the large one. This appears evident in the experiment of Valſalva, mentioned in the commentary on §. 276. nº 5. For when he made a ſtrict ligature with a thread upon the cardiac nerves of a dog, and removed the ligature ſoon after, the animal periſhed in a few days time, in the ſame manner as if theſe nerves had been divided; and yet there was no ſenſible injury appeared in the nerves after death: but the ligature ſo compreſſed the ſoft and pulp-like ſubſtance of the nerves, that the free influx of the ſpirits through them was wholly intercepted.

But why an incurable gangrene follows the deſtruction of a large nerve, and eſpecially from an injury of the ſpinal medulla, we have already declared in the commentary on §. 162, where ſome remarkable caſes are alledged for confirming this doctrine.

§. 327. EVEN a contuſion frequently deſtroys or cruſhes the viſcera themſelves; and then follow, An inflammation of them, a ſuppuration, a gangrene, ſcirrhus, and an injury of their functions.

What bad conſequences ſometimes follow after violent contuſions of the head, by which the brain itſelf is injured, has been already obſerved in the hiſtory of wounds in the head. The viſcera contained in the cavity of the thorax are on all ſides ſecurely defended by the arched ribs, the ſternum, and ſpina dorſi; and yet the wonderful caſe related at §. 323, demonſtrates, that even theſe viſcera may be ſometimes injured by contuſions, ſince a fragment of the ribs lacerated the external membrane of the lungs, and produced a ſurpriſing emphyſema, with death itſelf. But the abdominal viſcera are more liable to be injured by contuſions, as they are for the moſt part covered only by the ſoft integuments and muſcles of the abdomen; and tho' the ſpleen and the largeſt part of the liver are defended by the falſe ribs, yet have theſe viſcera been

ſome-

sometimes so violently crushed by contusions, that death itself has speedily followed, as appears from the observations related at §. 170, nº 3. Nor will this appear wonderful, if it be considered that the substance of the liver and spleen is so tender, that, unless great caution be used, they cannot be taken whole out of the dead body; from whence it is, that violent contusions of the abdomen so often prove fatal in a small space of time. Parey [a] relates, that two boxers fighting, one of them being of a small stature, but thick and strong, forcibly threw down the other, who was very tall; whereupon the tall one being enraged, took his elbow, and pushed it with the whole weight of his body against the scorbiculum cordis of his adversary, whereby the unhappy man instantly stretched out and expired. A large quantity of extravasated blood was found in the cavity both of the abdomen and thorax. There are innumerable observations to be met with in authors, from whence it appears that several of the viscera have been so injured from violent contusions, that the most direful maladies, and death, have thence followed. For by this means the vessels may be ruptured, and their contained juices extravasated, which by putrefying may corrode all the adjacent parts; whence again may follow the very worst consequences, as inflammation, with all its attendants, namely, a suppuration, gangrene, *&c.* And since the functions of all the viscera depend upon the continuity of their vessels, and the regular motion of the juices through them, it is again evident, that those functions may be impaired, or even totally abolished, by contusions.

§. 328. FROM hence (322 to 328,) it is easy to explain the many surprising and miserable symptoms and disorders which usually follow from contusions (321); and an infinite number both of acute and chronical diseases may be thence predicted.

If,

[a] Oeuvres d'Ambroise Pare. Apologie et Voyages, p. 783.

If, now, what has been ſaid at §. 322 concerning the idea of contuſion, with the inſeparable effects of every contuſion enumerated at §. 323, be applied to the ſeveral different parts of the body which are capable of being injured by contuſion, it will immediately appear what bad conſequences are thence to be feared; which may be then ſafely predicted, from the known fabric and uſes of the parts. For example, if any one ſhould fall and ſtrike the right hypochondrium againſt a hard obſtacle, and ſoon after a conſiderable yellowneſs appears in the eyes and ſkin; it will be thence evident, that the bile being preſſed back, has infected the maſs of blood; and that therefore the region of the gall-bladder, and liver itſelf, have been injured by the contuſion. If again it be conſidered, that the ſubſtance of the liver is ſo very tender, that it reſembles a ſponge full of blood, there is great danger leſt from the ruptured veſſels a large quantity of blood ſhould be extravaſated within the cavity of the abdomen; whence convulſions, faintings, and death itſelf, often enſue, in a ſhort ſpace of time. But if the injury is ſlight, and only the ſmaller veſſels are ruptured within the ſubſtance of the liver; even then the extravaſated humours may compreſs the adjacent veſſels, or elſe corrode them by putrefying, ſo as to produce an inflammation, ſuppuration, ſcirrhus, *&c.* in this viſcus; whence death ſlowly follows, after the patient has endured the greateſt miſeries. If the region of the loins ſhould be injured by a violent contuſion, and bloody urine follows, we know then that the ſmall veſſels of the kidneys are ruptured; whence again may follow the very worſt evils: for the grumes of congealed blood eſcaping into the narrow paſſages of the pelvis and ureter, may wholly intercept the courſe of the urine from the kidney to the bladder; whence an inflammation of the kidney, ſuppreſſion of urine, *&c.* may follow. Even a ſmall particle of congealed blood, left in theſe paſſages, may form the baſis of a calculus, to which the earthy particles will on all ſides adhere; whence a train of new maladies again follow. If now it be conſidered that the like injury may happen in the other viſcera, it will be very evident that innumerable

diſorders may thence follow, which will either kill the patient in a little time, by extravaſating the juices, and deſtroying the fabrick of the parts whoſe continuity is abſolutely neceſſary to life; or otherwiſe, the patient may ſurvive under the burden of diſeaſes, from the injured functions of the parts, whence many chronical and often incurable diſorders follow. This is demonſtrated by an unlucky accident in a bold commander, who ruſhing againſt the enemy upon a fierce horſe, it happened, that the horſe receiving a wound, ſuddenly raiſed himſelf, by which means the pummel of the ſaddle was very violently preſſed againſt the region of his ſtomach. A vomiting of much blood immediately followed; and as the noble perſon could not obſerve a proper regimen of life, but drank much wine, quite neglecting ſo great an accident, though he ſurvived a conſiderable time, he was troubled with excruciating pains in his ſtomach during life, till at length a very troubleſome vomiting, dyſentery, *&c.* put a period to his miſeries by death. On opening the body, a large part of the liver, and the whole pancreas, were found cancerous. Thus alſo the worſt maladies may follow from a contuſion of the teſticles. I ſaw a ſcirrhous teſticle from this cauſe, which, being imprudently treated with emollient and ſuppurating medicines, grew to ſuch an uncommon bulk, that the ſcrotum with its included teſticle nearly extended to the knee of the ſame ſide; and which was afterwards eroded by a frightful cancer, that occaſioned death, after the worſt calamities, in a perſon who was otherwiſe very healthy.

§. 329. A Preſent contuſion, with the part it affects, is known, 1. By inſpection, and by the touch. 2. By its effects: as pain, numbneſs, heavineſs; a change of the colour to red, brown, livid, or like lead, black, yellow, or green; a hæmorrhage, gangrene, *&c.* (323 to 328). 3. By comparing the ſhape and violence of the contuſing inſtrument, with the nature of the part injured.

This

This aphorism treats of those signs by which a contusion is known to be present, and by which the part affected is discovered.

1. For the vessels being ruptured under the entire skin, their extravasated juices fill and distend the panniculus adiposus: whence a tumour and softness of the contused parts appear to the eye and touch; and this more especially in contusions of the head, because the hard skull occasions the extravasated juices to make the greater distension of the integuments outwards: which is elegantly expressed by Terence, where a procurer being severely chastised for his deserts by a youth, says,

Omnes dentes labefecit mihi!
Præterea colaphis tuber est totum caput.
ADELPH. Act. II. Scen. ii. ver. 36.

2. Pain attends almost in every contusion: but when the contusion, being very violent, has destroyed almost all the vessels, there is then only a very obtuse or no pain; but in such a case there is a numbness, and a dull sensation in the affected part, which denotes that the sensible nerves are destroyed in the contused places, or else are so compressed by the extravsaated humours and the contusing instrument that they remain no longer sensible. But as the extravasated blood is generally collected under the entire skin, the colour of the contused part will be altered, according to the different quantity of extravasated blood, and also according to the different time that is passed since the contusion was inflicted. For a slight contusion is followed with a red colour, there being but little blood extravasated, from a rupture only of the smaller vessels; but yet that redness becomes more obscure after a few hours, and inclines to black. But after a violent contusion, the colour of the part affected is often instantly changed to a leaden, livid, and frequently a black, from the large quantity of blood lodged under the entire skin; and although the colour was red at first, yet, by the exhalation or absorption which is afterwards made of the thinner parts of the blood, the remainder turns black. But this leaden or livid colour of the contused part ought not to give any great alarm;

for it is not always the mark of a gangrene, which may be eaſily diſtinguiſhed by the coldneſs and elevation of the cuticle into veſicles full of ichor. When the concreted blood begins to diſſolve and be diſperſed, then the leaden or black colour becomes gradually fainter, and begins to incline to red; and a yellow or greeniſh colour appears in the margin of the contuſed part, from the gradual diſſolution and diſſipation of the red part of the blood; which green or yellowiſh coloured margin is therefore a ſign that the extravaſated and concreted juices begin to be diſſolved. It is well known, that when blood is drawn from the vein of a healthy perſon, it ſhortly ſeparates into two parts; the one a limpid ſerum, and the other a red concrete floating in the ſerum. If now all the ſerum is poured off, there will appear a conſiderable quantity more in a few hours time, as the red concrete gradually diſſolves; ſo that, by frequently pouring off the ſerum, almoſt the whole red part will at length vaniſh. The ſame diſſolution ſeems to happen in theſe contuſions, where the concreted blood is by degrees reſolved into a thinner ſerum; from whence follows that change of colour in the contuſed part, when the extravaſated blood begins to be attenuated and diſperſed. This circumſtance has been well obſerved by Hippocrates [b], where he treats of a fracture in the calcaneum: for he reckons it one of the beſt ſigns, denoting that there is no danger, if in contuſions (ἐχυμώματα) the circumjacent parts look greeniſh, without hardneſs and black ſpots; and adds, that this ſign is of the beſt import in every contuſion, *&c.*

Unleſs a conſiderable wound is made in the ſkin, there ſeldom happens any profuſe hæmorrhage in a contuſion; for the blood extravaſated from the ruptured veſſels, being collected in the panniculus adipoſus, congeals, and ſtops up the courſe of the blood which is about to eſcape. But if the viſcera or larger veſſels are much injured by contuſion, a large quantity of blood may be extravaſated within the cavities of the body; as when, for example, the liver ſhall be thus hurt: but then paleneſs, coldneſs of the extremities, great weakneſs,

[b] De Fracturis, textu 30 & 31. Charter. Tom. XII. p. 205.

neſs, fainting, *&c.* ſufficiently denote ſuch an internal hæmorrhage. But when all the veſſels in any part of the body are ſo deſtroyed by a violent contuſion, as totally to aboliſh the vital influx and reflux of the juices into and from the part, a gangrene or death of that part is then preſent.

3. We know a contuſion is preſent, when we are informed that ſome hard and obtuſe body in motion has ſtruck upon the part, or that ſome part of the human body in motion has been forced againſt ſome ſuch hard obſtacle. Hence a wound is frequently accompanied with contuſion, unleſs the wounding inſtrument was ſharp. At the ſame too the nature and ſituation of the part injured muſt be alſo conſidered; as for example, that the viſcera of the thorax are leſs expoſed to injury by contuſions, and that the viſcera of the abdomen are more eaſily expoſed to the ſame injury.

§. 330. AND it is hence well known, 1. That an internal and large contuſion, in one of the more noble viſcera, is incurable; and muſt therefore occaſion ſeveral diſeaſes, and death itſelf. 2. That a contuſion in the bones is very dangerous, and difficult to cure; eſpecially when near their articulations or medulla. 3. That a contuſion of the ſkull is worſt of all, as we before demonſtrated, from the vicinity of the brain. 4. That contuſions of the larger glands ſeated at the ears, arm-pits, breaſts, or the groins, uterus, pancreas, *&c.* threaten a ſcirrhus, cancer, and the diſorders that may thence follow.

What prognoſis ought to be formed, from a knowledge of the part injured by contuſion, is made evident in this aphoriſm.

1. For the veſſels being ruptured, will either produce a fatal hæmorrhage, incapable of being ſuppreſſed; or elſe the contuſed parts muſt be ſeparated by ſuppuration from the ſound, as Hippocrates obſerves in the

place cited from him in the commentary on §. 323: but from internal ſuppurations a conſumption very frequently follows, which ſlowly deſtroys the unhappy patient. Beſides this, ſince all the viſcera have a ſhare in conſtituting the health of the patient, therefore the function of the diſeaſed viſcus will be ſo much depraved after the ſuppuration, that if the patient ſurvive, it will be in a miſerable and diſeaſed ſtate. Now as theſe injuries by contuſion happen more frequently in the liver and ſpleen, from the exceeding tenderneſs or friability of thoſe viſcera, it is very evident, that the worſt conſequences may be there expected, and that the cure will be extremely difficult, the patient being very rarely reſtored to a perfect ſtate of health, becauſe more or leſs of a ſcirrhus almoſt conſtantly remains during life, which will diſturb the functions of the injured viſcera.

2. For a rupture of the veſſels which afford life and nouriſhment to the lamellæ of the bone, will occaſion them to mortify and ſeparate. But if ſuch a contuſion is made near the articulations in the larger bones, there is ſcarce any room to hope for a ſeparation or exfoliation of the dead parts: becauſe in thoſe places the lamellæ of the bones recede from each other, and form cells, in which the blood-veſſels are diſtributed in great numbers, together with thoſe veſſels which contain the thin oil; which juices will be therefore corrupted by ſtagnating, and acquire a putrid acrimony ſufficient to deſtroy the parts; whence a caries of the bone, and all the maladies that may thence follow. But if the medulla itſelf is affected, the very worſt or rancid acrimony thence follows, ſufficient to corrode the whole ſubſtance of the incumbent bone. See what has been ſaid in the commentary on §. 325. To which add, that the bones cannot be contuſed near their articulations, without at the ſame time injuring the ligaments which articulate the bones; whence excruciating pains, anchyloſes, *&c.* may follow.

3. Of this we treated before, in the hiſtory of wounds in the head.

4. Conſult what has been ſaid in the commentary on §. 324.

§. 324. In all the places here enumerated there are very conſiderable glands ſeated, from a contuſion in which the very worſt maladies may follow. Among ten caſes where the breaſts are ſcirrhous or cancerous, nine of them are probably from contuſion. Agreeable to this, I ſaw an unhappy woman, whoſe child lying with her, with its whole weight upon her breaſt, made a contuſion with its elbow, by endeavouring to turn itſelf, whence a ſcirrhus followed throughout the whole breaſt, which was conſiderably tumefied, and in a few weeks time degenerated into a frightful cancer. The like injuries have been frequently obſerved in the parotid, axillary, and inguinal glands, ariſing from contuſion. But the uterus, in women who are not with child, is ſufficiently well ſecured on all ſides, by the bones of the pelvis; ſo that it cannot be eaſily contuſed, as it may in thoſe who are far gone with child, when the bottom of the uterus riſes up above the oſſa pubis: but the uterus may be alſo injured by the imprudent handling of the midwife, or by the difficulty of the birth; from whence a ſcirrhus of the uterus, degenerating into a cancerous ulcer, has been very frequently obſerved.

§. 331. IN the cure of a contuſion, it muſt be always endeavoured to procure a diſcuſſion, to prevent a ſuppuration, and more eſpecially a gangrene.

Since the ſolid parts of the body are broken in pieces by contuſion, and the extravaſated juices are let into foreign parts; it is therefore required, in order to a cure, to diſcharge the extravaſated juices, and to unite the ſolid parts which are divided. This will be moſt happily procured, if the concreted juices are rendered fluid; for then they may be abſorbed by the bibulous veſſels, and returned into the common courſe of the circulation. This method of cure is ſaid to be by *reſolution* or *diſperſion*. But a ſuppuration muſt be here avoided, if poſſible: becauſe by that means much of the ſubſtance of the contuſed part is deſtroyed, by a ſepa-

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ration of all that does not admit the circulating juices, from whence unſightly ſcars frequently remain; and the cellular membrane being conſumed after a violent ſuppuration, often occaſions the muſcles and tendons to adhere to the adjacent parts, whence their action is either depraved or aboliſhed. It is indeed true, that a ſuppuration cannot always be prevented: but it is equally true, that ſome contuſions may be frequently removed or diſperſed by the application of thoſe remedies mentioned in §. 333, 334; by the neglecting or the too late uſing of which, a ſuppuration would certainly take place. But it is very evident, that a gangrene ought to be ſtill more induſtriouſly avoided, as that wholly deſtroys the vital influx and efflux of the juices to and from the part affected; which being afterwards mortified, muſt be then ſeparated by ſuppuration from the adjacent living parts.

§. 332. A Reſolution or diſcuſſion is procured by removing the extravaſated juices, without any farther injury to the veſſels.

It is a general indication in all contuſions, to remove the extravaſated juices; but if, for example, a diviſion of the contuſed part by inciſion will give a vent to the extravaſated blood, this cannot be termed *reſolution*, becauſe the parts ſuffer a new injury. The ſame is alſo true, when the cure is performed by ſuppuration; for then the extremities of the injured veſſels are ſeparated, and diſcharged with the extravaſated juices in the form of pus. But in order to a reſolution, it is required that no farther injury be offered to the parts, while the extravaſated juices are in the mean time carried off. And this is what Hippocrates [a] terms the *drawing up* or *abſorption* of extravaſated blood: for in treating of thoſe diſorders which follow a contuſion of the fleſh about the ribs, without a fracture of them, after deſcribing the proper remedies, he adds, that a ſuitable bandage is neceſſary; εως αν ξηρανθη μεν, ϗ αναποθη τυτο το εκχυμωμα, το εν τη θλασει γενομενον; "But as for the blood which is ex-

"travaſated

[a] De Articulis, textu 66. Charter. Tom. XII. p. 397.

" travaſated in the contuſion, let it be dried up and " abſorbed." But in what manner, and by what means, this reſolution may be obtained, is declared in the following aphoriſm.

§. 333. NOW this reſolution is procured, 1. By rendering the juices fluid; 2. By relaxing the adjacent veſſels; and, 3. By directing the juices into the veſſels, by evacuating them, and by frictions.

1. The blood extravaſated from the veſſels, immediately concretes; and by that means is rendered unfit both for paſſing through the ſmaller blood-veſſels, and for being abſorbed by the mouths of the veins. The firſt thing therefore required, is, to render the concreted juices fluid: For if the extravaſated juices can be reduced to the tenuity of water, they will certainly be diſperſed, provided the body is healthy in other reſpects. Hippocrates [a] pronounces, That the fleſh attracts or abſorbs, both from within and without. And he alſo acknowledges the whole body to be perſpirable, or exſpirable and inſpirable. The extravaſated juice will be therefore abſorbed by the bibulous veins, which open in all the larger and ſmaller cavities of the body, provided it be ſufficiently attenuated to enter them.

2. All the attenuated juices which are to be abſorbed, muſt enter the exceeding ſmall bibulous veins, and be conveyed by them to the larger branches. Now it appears from inconteſtible experiments, that any of the ſmalleſt tubes, made of the pureſt glaſs by drawing out at a lamp, upon having one end immerged in any liquor, will attract the liquor into their cavity; and that the liquor will aſcend higher into the tube, as it is of a ſmaller bore, and more inclined from the perpendicular towards the horizon; but the moſt of all when one end of it is inclined lower than the other, for then the attractive force by which the liquor is drawn into the tube is aſſiſted by gravity. The like action

[a] Lib. vi. Epidem. in initio. Charter. Tom. IX. p. 540.

action ſeems to obtain, when the extravaſated humours, being firſt attenuated, enter the exceedingly minute tubuli of the abſorbing veins. But the valves which are conſpicuous in the ſmalleſt lymphatic veins, prevent their contained humours from reſiſting the ingreſs of the abſorbing juices. Now flexible canals are the more eaſily filled, in proportion as their ſides give a leſs reſiſtance; and therefore relaxation of the adjacent veſſels facilitates the courſe of the abſorbed juices, through the exceedingly minute ducts, into the larger venous branches; which is here required.

3. The juices, thus abſorbed by the minute venous ducts, will go on more eaſily through the large venous branches as they contain leſs humours to be moved; provided the powers, which promote the motion of the venous blood, remain the ſame; *viz.* principally the pulſation of the arteries contiguous to the veins, with the motion of the muſcles; for the muſcles ſwelling in their action, compreſs the adjacent veins, and drive the blood through them towards the heart. If therefore the maſs of humours to be moved is diminiſhed, and the moving powers remain equally ſtrong, it is evident that the veins will be more ſpeedily evacuated, by which means the juices to be abſorbed by the minute bibulous ducts will have a more eaſy entrance. This doctrine is alſo confirmed by experiments; for when men travel in the ſcorching ſun, having their bodies rough, and their mouths parched with thirſt, they have been ſurpriſed to find their thirſt extinguiſhed, and their mouths moiſtened, after bathing, which has rendered the whole body ſo moiſt and ſoft, that none of the former roughneſs appeared. This is an experiment produced by Galen [b], to prove, that the whole body is inſpirable. For by violent exerciſe in a very hot air, many of the thin juices are exhaled from the body; by which means, becoming very dry and bibulous, it eagerly abſorbs the water contiguous to its external ſurface. Perhaps it may be from hence that the body is filled with watery humours, after great loſſes of blood, when the ſmall abſorbing veins very eaſily

[b] Commentar. in lib. vi. Epidem. Hippocr. Charter. ibid. p. 541.

eaſily diſcharge the abſorbed humours into the larger empty veins: but in the mean time, the ſtrength being weakened, and the heat of the body diminiſhed, occaſions the thin watery juices to be accumulated in the larger and ſmaller cavities of the body, which are ſaid by Hippocrates to contain ſpirits in a healthy ſtate, and ichor in a diſordered ſtate, as we obſerved in the paſſage before cited in the commentary on §. 323. And perhaps from thence may be deduced the reaſon why dropſical patients ſo ſoon ſwell again, after all the water has been diſcharged by paracenteſis, or any other way, even though they abſtained from drink: for notwithſtanding a very large quantity of water is collected in the cavities of the body of the dropſical patient, yet the reſt of the veſſels collapſe, and are evacuated, whence the reſt of the body conſumes in proportion as the abdomen is diſtended in an aſcites, and whence the body becomes more bibulous.

But frictions, with a gentle compreſſion, act more upon the veins than upon the arteries, becauſe the coats of the veins are thinner; whence the veins will be emptied: And as there is an alternate compreſſure and relaxation of the parts in all frictions, the veins will by that means be firſt emptied, and then directly filled again: ſo that frictions will produce much the ſame effect with evacuations; namely, by emptying the veſſels, they will facilitate the ingreſs of the juices, to be abſorbed thro' the ſmall mouths of the bibulous veins. Add to this, that the extravaſated and concreted blood itſelf will alſo be attenuated and reſolved by the friction: for if the blood taken from vein of a healthy perſon, and congealed in the open air, be ground in a glaſs morter, it will be again diſſolved into a frothy and red-coloured liquor; and therefore frictions are evidently of the greateſt uſe in the cure of contuſions.

§. 334. THEREFORE plentiful blood-letting, with the exhibition of a cooling purge that acts briſkly without inflaming; the application of diſcutient, relaxing, and penetrating fomen-

fomentations to the part itſelf; with warm frictions, and the internal uſe of attenuating, ſudorific, and diuretic medicines; will be here ſerviceable.

In this aphoriſm are enumerated the moſt efficacious remedies for anſwering the curative indications propoſed in the aphoriſm preceding.

Plentiful blood-letting.] For this is one of the chief remedies in all contuſions, provided the patient is ſtrong; and therefore it ought to be boldly uſed, and repeated, as may be found neceſſary. Thus an intenſe fever and inflammation, which are the moſt to be feared in theſe diſorders, may be prevented; becauſe the groſſeſt parts of the juices, namely, thoſe of the red blood, are thus evacuated from the veſſels, and an eaſy paſſage given to the thinner juices taken into the body. At the ſame time, alſo, the depletion of the larger veins by phlebotomy will facilitate abſorption, and the tranſmiſſion of the juices imbibed by the ſmalleſt veins towards the larger branches, whence the extravaſated blood will be more readily diſperſed.

With the exhibition of a briſk purge, ſoon after, that will not inflame.] Thoſe medicines which are called *purgatives*, do not only evacuate thoſe humours which before exiſted under the ſame form within the body, as they appear in at their diſcharge; but they alſo diſſolve the healthy juices, and evacuate them from the bowels when diſſolved, as was proved in the commentary on §. 201. And from hence Eraſiſtratus and his followers rightly concluded, That purging is an evacuation made with a corruption and alteration of the humours evacuated. Galen [a] indeed eſpouſes the contrary opinion; but the other ſeems to be truly the caſe. For ſcammony being given to the moſt healthy perſon, ſo diſſolves the ſound juices, that, being melted into a thin water, they are diſcharged by ſtool in an incredible quantity; and if the uſe of the ſame medicine be frequently repeated, the whole body will be emaciated, the veſſels will collapſe, and extreme weakneſs will follow.

[a] De Purgant. Medicam. Facult. cap. 2. Charter. Tom. X. p. 464.

low. All which ſufficiently evince, that the juices were not evacuated, as exiſting before in a morbid ſtate; but that the ſound humours are expelled from the body, after they have been diſſolved into a thin and fetid water by the force of the medicine. By theſe remedies, therefore, the veſſels are emptied, and the humours diſſolved, while at the ſame time the ſmall veins are rendered extremely bibulous; as they open throughout the whole external and internal ſurface of the body, which is evident from a remarkable experiment. A young man having a fever, attended with a diarrhœa and a great ſtupidity of his ſenſes, would not take any thing by the mouth; tho' the fever in the mean time continued to dry up the body by its heat: hereupon the phyſicians ordered his feet to be immerged in warm water; which being done, a ſurpriſing conſumption of the water in the veſſel was ſpeedily obſerved, and ſoon after followed an impetuous diſcharge of the ſame water, almoſt uncoloured, by the anus [b]. Hence it is evident, that theſe purges very well ſatisfy the indications of the firſt and ſecond number of the preceding aphoriſm: for the humours are thus diſſolved, the veſſels evacuated, and that power increaſed by which the juices are abſorbed by the bibulous veins.

But it muſt be at the ſame time remarked, that thoſe ſtrong purges which act by exciting violent motion are not uſeful in this caſe; ſuch as, the colocynthis, euphorbium, *&c.*: but ſuch only are here uſeful, as, having a power to diſſolve the juices, do notwithſtanding produce their effects without much diſturbance; as ſcammony, jalap, leaves of ſena, *&c.* of which various forms are prepared in the *Materia Medica Boerhaaviana.*

Penetrating fomentations, *&c.*] As the extravaſated blood lies generally congealed under the entire ſkin of the contuſed part; it ought therefore to be rendered fluid in ſuch a manner, as to prevent it from putrefying at the ſame time. Now congealed blood gradually diſſolves, barely by expoſing it to the open air: but then it alſo putrefies; and therefore it is neceſſary for

[b] De Re Medica Diſſertat. quatuor Thomæ Simſoni, p. 183.

theſe fomentations to have a power of reſiſting putre faction, as well as of attenuating and diſſolving. Such a fomentation may be made of ſal-ammoniac, or ſea ſalt, diſſolved in twenty times as much water, with the the addition of a fourth part of wine and an eighth part of vinegar; which being applied warm, will anſwer all theſe intentions. For the water in it relaxes; while the ſalt, wine, and vinegar, prove good diſſolvents, and at the ſame time prevent any putrefaction. The urine of a healthy perſon, mixed with a ſmall quantity of vinegar, compoſes a fomentation of the like nature; with which thoſe tumours of the head which ſo frequently reſult from contuſion in children are happily diſcuſſed.

Several medicinal ſimples poſſeſſing a diſſolving power may be alſo infuſed in the water for this purpoſe; and the form of ſuch a fomentation may be ſeen in the *Materia Medica* of our Profeſſor. Various emplaiſters are alſo adapted to this intention, which may be ſeen enumerated in the *Materia Medica* correſponding to this aphoriſm. Theſe laſt, while they adhere to the ſkin by their tenacity, reſtrain the moſt ſubtile juices from exhaling, and repel them in a manner to the part upon which they are applied; ſo that the part affected continues as it were in a bath of its own vapours, which relaxes the veſſels; and then the aromatic or fragrant particles of the emplaiſter, inſinuating themſelves into the relaxed veſſels, frequently produce the deſired effect. Fomentations are not ſo ſerviceable, unleſs they are continually retained warm upon the affected parts.

Warm frictions upon the part.] If no inflammation, nor any great pain, appears in the contuſed part, gentle frictions are extremely uſeful. For by this gentle agitation, the concreted blood is attenuated and divided, ſo as to be capable of returning thro' the ſmall mouths of the bibulous veins. At the ſame time alſo the veins are thus emptied, ſo as to facilitate the motion of the abſorbed humours through the depleted veſſels, as we ſaid before in the commentary to the preceding aphoriſm. Thus a man was ſo abuſed by ſome miſchievous perſons, that his whole face was frightfully tumefied by contuſion; but by theſe fomentations, joined with continual

continual and gentle frictions, the tumour was happily diſperſed, inſomuch that no manner of ſuppuration followed, and his face recovered its former ſhape, contrary to all expectation.

Internal attenuating medicines, *&c.*] Thoſe medicines which reſtore the concreted parts of a fluid to the ſame ſtate of fluidity which they poſſeſſed before concretion, are termed *attenuants* or *reſolvents*. Among theſe, warm water has the chief place; partly inaſmuch as it dilutes, by inſinuating itſelf betwixt the concreted particles; and partly, becauſe it is the vehicle that diſſolves all other medicines, concerning which you may conſult what has been ſaid before in the commentary on §. 54, nº 4. Phlebotomy therefore being premiſed, with the uſe of thoſe antiphlogiſtics or cooling purges which powerfully diſſolve the humours without putting them into any violent commotion; it will be next moſt convenient to give a large quantity of ſome decoction which contains much water, repleniſhed with ſuch particles as may by a gentle ſtimulus excite the veſſels to act a little more powerfully upon their contained juices, and alſo that the unactive water may not be retained or accumulated within the body, obſerving likewiſe to chuſe ſuch ingredients as reſiſt putrefaction. Hence it is that the infuſion of ſcordium, rue, horehound, *&c.* with the five opening roots, the three ſorts of ſanders, nitre, honey, *&c.* are ſo very ſerviceable in theſe caſes. For when the veſſels, being firſt depleted by phlebotomy and the uſe of purges, are continually filled by drinking theſe decoctions warm, while at the ſame time the contuſed parts are continually treated with fomentations and gentle frictions ſo as to derive the action of the internal medicines to the injured part, (for which ſee the commentary on §. 134.), every thing is then done that can be expected from art. For then warm water, repleniſhed with the diſſolving virtues of the preceding remedies, will every moment be conveyed to the extravaſated humours, which will be thus diluted, diſſolved, and rendered fit to return into the ſmalleſt veins; ſo that all the extravaſated juices are thus carried off, without further injury: which is the

thing required by the intention. But since all these remedies, taken in large quantities, are usually again discharged from the body, either by a diaphoresis, or by the urinary passages; therefore, by a difference of regimen, they act either as sudorifics or diuretics: for in a person who is on all sides encompassed with a warm atmosphere by lying well covered in a bed, they will excite a sweat; but if the patient remains in a cold air, that generally occasions a more copious discharge by urine.

§. 335. THE order of which remedies, with the necessity of repeating them, and in suitable doses, is determined by (334), with the dangerousness of the case.

There is no necessity to use all these assistances of art, in every contusion; for slight accidents of this kind may be removed barely by the use of fomentations, composed of urine, salt, vinegar, and the like: but when there is danger of a violent inflammation, with a stoppage of the circulation, and a gangrene; then all the forementioned remedies are to be brought into use. In that case, therefore, we are to begin with phlebotomy, using it liberally, if the patient's strength will permit; and, in the next place, to give the forementioned purgatives, that, by dissolving the humours, and weakening the vital powers, the body may be far from being inclined to inflammation or fever. If the tumour, pain, and inflammation, do not yet diminish by the use of these means, they are to be boldy repeated, especially when the contusion has injured some internal part: for then the worst consequences may be feared, from a suppuration; or else an incurable scirrhus may remain, from the imperfect cure of the disorder, which may terminate in a cancer, and produce the most grievous symptoms. But when the symptoms diminish by the use of these means, then, if the affected part is accessible to the hand, gentle frictions will be extremely useful; and not before: for the tense and inflamed parts, distended by the extravasated humour, may by a rough friction be rather excited to a speedy gangrene.

§. 336. AT the same time also a very thin diet, of aliments the least apt to putrefy, is here required.

For the intention requires to dilute plentifully all the juices, and to support life in such a weak state that there may be no danger of inflammation; and as the extravasated humours are spontaneously inclined to putrefaction, therefore a diet of such aliments is to be chosen as will resist that kind of alteration in the juices. Hence a decoction of barley, oats, rice, bread, and the like, in milk and water, with boiled apples, and other ripe garden-fruits, are here highly recommended; as are also weak flesh-broths, boiled with rice or barley, and mixed with a little citron-juice. Nor is there any danger that this weak aliment will be insufficient to support life; for the human body at rest may be supported even by the poorest nourishment. This is what the celebrated Boerhaave experienced himself, when, being tormented by the most severe pains in a rheumatism, he lived for the space of twelve days upon whey alone; and yet he continued in good strength, sufficient for exercising the muscles, if the pain had not opposed. But the body being weakened by bleeding and the use of purges, cannot act so powerfully upon the ingested aliments, to change them into its own nature; whence the aliments will be more easily inclined to degenerate spontaneously according to their own nature. But as a putrefaction is to be feared in the extravasated juices, therefore such aliments are principally recommended in the diet, as have naturally a greater inclination to acidity; and for the same reason likewise, flesh, eggs, fish, and the like, are to be avoided. All acrid sauces, spices, and the like, are also pernicious, by increasing the motion of the circulation, which ought in this case to be rather weaker and more sedate. But in all these cases a regard must be likewise had to the season of the year, with the healthy or morbid constitution and custom or course of life in the patient, *&c.* concerning all which you may consult what has been said in the commentaries on §. 192 to 196.

If all that has been said concerning diet, and the remedies afforded by pharmacy and surgery, be duly observed, they will be always attended with success when the disorder is curable: but all other boasted specifics for contusions ought not to be trusted to alone for the cure of the disorder; tho' many of them are innocent, and may be used, provided the forementioned very efficacious means are not neglected. Thus Helmont[a] recommends the dried blood of a goat, that follows after cutting off his testicles, to be given to such as fall from high places, in order to disperse the concreted blood in the contusion. Others recommend spermaceti, a decoction of madder, *&c.*

§. 337. BUT if the contusion is so large that it cannot be resolved, and is at the same time accessible to the hands, a scarification, incision, or suppuration, must take place; observing what has been said in (334.) Or else, if the contusion is so great, as totally to destroy the life of the part; or is so conditioned, that one may thence certainly foresee that intolerable pains, inflammations, a suppuration, consumption, fever, or death itself, will follow; an amputation ought then to be timely made, when that is practicable, (464 to 475).

When the contusion is so great that one can by no means hope to disperse the extravasated juices, without further damage to the vessels, the only remedy that then remains, when the contused part is accessible to the hand, is, To make an opening for the discharge of the extravasated juices; and then to deterge the parts by a mild suppuration, so as to reduce them to the state of a clean wound. For if this method is not taken, the extravasated juices compressing the adjacent vessels, may occasion an inflammation; or, by wholly suppressing

[a] Ortus Medic. in capit. *Plura Furens*, p. 322. n° 32.

fing the vital circulation in the part, a gangrene may follow, which, if attended with a putrefaction, may occaſion ſtill worſe conſequences. In this caſe, then, the contuſed part is to be entirely divided, or elſe punctured in many places by ſcarifying with a lancet, to give a free diſcharge to the extravaſated humours; and then the ſubjacent living parts, being ſet at liberty from the compreſſure, will expel and caſt off all that that has been ſo injured by the contuſion as to be no longer obedient to the laws of the circulation. But this ought more eſpecially to be performed when the very dangerous conſequences reſulting from an inflammation or eroſion of the adjacent parts are to be feared, as was obſerved before, in the Hiſtory of Wounds in the Head, in §. 243, 244, 248.

But notwithſtanding the difference of the caſe, the remedies mentioned in §. 334 ought not to be here neglected; for if the inflammation proves too violent in the contuſed part, it may produce a gangrene inſtead of a laudable ſuppuration. Therefore phlebotomy and cooling purges are here highly uſeful, joined with thoſe fomentations which reſtrain putrefaction: and at the ſame time it will be always uſeful to give large quantities of the attenuating decoctions, that all ſuch parts of the corrupted juices or purulent matter, which have infected the maſs of blood by returning through the bibulous veins, may be diſcharged from the body, either by a diaphoreſis or the urinary paſſages. As it appears from what has been ſaid before, that the extravaſated blood may be ſo attenuated as to be abſorbed by the bibulous veins; ſo alſo may the matter or corrupted ichor return the ſame way, and infect the blood, ſo as to produce a very bad ſtate of the juices, from whence again various bad conſequences may follow.

But when a violent contuſion has ſo injured the larger veſſels, or has ſo far deſtroyed the fabric of the part, that the vital circulation of the juices is there no longer continued, a perfect blackneſs or mortification thereof follows, which deſtroys them all. In that caſe there is but one remedy remaining; namely, to extirpate the part, that the life of the patient may be pre-

preſerved. That this is the ſtate of the diſorder, may be known, if no warmth nor any ſenſation remains in the contuſed part, even though it be deeply ſcarified; and a putrefaction ſpeedily following, affords a cadaverous ſmell. If now the part thus affected be not ſpeedily extirpated, by the ſpreading of the ſphacelus the patient will be ſoon deſtroyed. Such a caſe happened to an expert coachman, who, in breaking ſome unruly horſes, fell off the chariot by their running away; whence his legs being unhappily twiſted in the wheels were cruſhed to pieces in ſuch a manner, that neither ſenſe nor warmth any longer remained in the parts; but as this man would not admit them to be amputated, which was here abſolutely neceſſary, he therefore expired on the fourth day after. The ſame is alſo true, if the bones are ſo fractured by a violent contuſion, that they ſeparate into ſmall fragments or ſplinters, which, by pricking and irritating the nervous parts, may produce the moſt ſevere pains, violent inflammations, and the bad conſequences which may thence follow. A man had his right hand ſo violently contuſed by the falling of a caſk of wine, that the bones of the metacarpus, which ſuſtain the index, middle, and ring finger, were cruſhed to pieces, together with the adjacent muſcles and veſſels. The celebrated ſurgeon that was employed, affirmed, that there was no remedy remaining but an extirpation of the contuſed parts; and that, if the operation was neglected, a train of the worſt ſymptoms would ſoon follow. But yet the wounded patient was unwilling to ſuffer the operation; and notwithſtanding the beſt remedies were applied for the ſpace of two or three days, the pains were ſo very ſevere, the inflammation ſo violent, and the tumour ſo large, that it evidently appeared a gangren would ſoon follow; but the contuſed parts being then immediatley amputated, the patient was happily cured [a]. But how much may be effected, even in the moſt deſperate caſes, by an intrepid courage in the patient, with great ſkill and dexterity in the ſurgeon, may appear in the following hiſtory, taken from the fore-

[a] De la Motte Traite Complet de Chirurgie, Tom III. p. 247.

forementioned author [b]. A captain of a ſhip of war had his whole arm, by an unlucky accident, ſo miſerably contuſed, even up to the ſhoulder, that neither ſenſe nor warmth remained throughout the whole limb; and although a true ſphacelus had already ſpread itſelf beyond the ſhoulder, and the whole arm was corrupted with a cadaverous ſtench, the ſurgeon confiding in his art, and the patient full of courage, preferred a doubtful remedy before certain death: whence the limb was immediately amputated in the articulation; and nature, being afterwards aſſiſted with proper remedies, ſeparated the reſt, which was already corrupted: ſo that in two months time he returned ſafe to his friends, ſnatched in a manner from the jaws of death.

§. 338. BUT more may be performed by the preceding method (331 to 336) than any one would imagine; becauſe nature herſelf is always ready to aſſiſt towards a ſpontaneous ſeparation, attenuation, reſolution, diſperſion, and expulſion, in the parts affected.

But yet recourſe ought not to be had immediately to amputation, ſince the moſt faithful obſervations teach us, that ſuch diſorders have been ſometimes happily cured, though they have ſeemed altogether deſperate. Therefore it ſeems to be moſt adviſeable, always to make trial firſt of the methods propoſed in the aphoriſms here cited, whenever that may be ſafely done: and in the mean time we are furniſhed with ſeveral remedies, by which the parts, even though mortified, may be ſo preſerved, that the putrefaction will not eaſily ſpread; ſuch as *alliaria*, *ſcordium*, *marrubium*, *ſalvia*, *ruta*, &c. which being infuſed in water, with the addition of ſalt, vinegar, and wine, or the ſpirit of wine, form a fomentation, which, being applied warm both by day and night, certainly reſtrains all putrefaction; ſo that one may ſafely wait a few days to ſee whether nature will attempt a ſeparation, or whether there appear any ſigns of life returning again into the part. Thus

[b] Tom. III. p. 408.

Thus our celebrated profeſſor uſed to tell his audience, that a German nobleman belonging to this univerſity was flung out of a chaiſe, and the wheels running over his legs, miſerably fractured the tibia and fibula of each leg, with a frightful laceration of the adjacent parts, which, though invaded by an incipient gangrene, were cured by the uſe of theſe remedies. There is alſo a ſurpriſing inſtance related in the obſervations of the celebrated Le Motte [a], of a young man, who received ſuch a violent blow upon the anterior part of his right arm, that a violent contuſion appeared to extend itſelf from the cubitus to the carpus, attended with extreme pain: the patient had applied linen cloths dipped in ſpirit of wine; but, perceiving ſcarce any relief from thence, was obliged to have recourſe to a ſurgeon. The pain had now almoſt vaniſhed in the hand, but was more violent in the cubitus; the affected hand appeared pale, and quite cold; and the ſkin, upon being roughly handled, came off from the ends of the fingers. No pain was perceived in the hand, even by deep ſcarifications made with a lancet; nor did ſo much as a drop of blood follow, after thruſting a lancet quite through it; and this coldneſs and inſenſibility extended to the middle of the cubitus. The parts were fomented with ſpirit of wine mixed with ſalt and *unguent. Ægypt.*; and at the ſame time a cataplaſm was applied, compoſed of barley-meal, with the flour of beans and lupins, mixed with ſpices and wine: by the uſe of which remedies the warmth and ſenſation returned down to the carpus, the whole hand as yet remaining cold and ſenſeleſs; and though it had continued thus for the ſpace of five days, was neither fetid nor black-coloured. Scarifications being again made in the hand, warm oil of turpentine was afterwards applied, and then the other remedies as before, for the ſpace of five days more, without any alteration in the parts: but from that time the warmth and life began to return, and the patient was happily cured without any amputation; only two of the fingers remained afterwards contracted, with

[a] Traite complet de Chirurgie, Tom. III. p. 405.

with a ſtiffneſs in the reſt. Since therefore the contuſed part could be thus preſerved in ſo deſperate a caſe, it ſeems to be the duty of a prudent ſurgeon or phyſician not to have recourſe to amputation, unleſs all other means have proved abortive. For if the force of the blood may be ſo abated by phlebotomy and the uſe of other remedies, that there is no danger of an inflammation or gangrene from the contuſion, and at the ſame time ſuch applications are uſed externally as reſtrain putrefaction, joined with a thin diet not at all inclined to putrefaction, there is great room to hope that the corrupted parts will be ſeparated from the living, and that the loſt ſubſtance will be afterwards regenerated.

Of FRACTURES.

§. 339. IF the parts of a bone are violently ſeparated from their coheſion into large fragments, it is called a Fracture.

Hitherto we have been treating of a ſolution of continuity in the ſoft parts of the body, and we come now to conſider the ſame diſorder in the bones. But a ſolution of continuity in a bone is by the Latins diſtinguiſhed by the name of *fractura*, called by the Greeks κατάγμα [a]: though a ſolution of continuity made in the cartilages has never obtained a diſtinct name, but is comprehended under the title of *Fracture*; at leaſt Hippocrates [b] uſes this name in treating of fractures in the joints, which are wholly cartilaginous, where he ſays, ην δε ως κατεαγη, &c.

But it is cuſtomary not to apply the term *Fracture* to every ſolution of continuity in a bone, but only to that which is made by ſome external violence, as Ægineta [c] obſerves, where he ſays, That, in general, a fracture is either a divulſion, rupture, or cutting aſunder of the parts

[a] Galen. Meth. Med. lib. vi. cap. 5. Charter. Tom. X. p. 143.
[b] De Articulis, text. 48. Charter. Tom. XII. p. 361. [c] Lib. vi. cap. 89. p. 96. verſa.

parts of a bone, made by ſome external violence. For thus a fracture is diſtinguiſhed from a *caries* of the bone. It is alſo added in this definition, That it is called a *fracture*, when one part of a bone is ſeparated from its coheſion with the other; in order to diſtinguiſh it from a *luxation*, in which the naturally contiguous bones are removed from each other. And then, to diſtinguiſh a fracture from a *contuſion*, which ſuppoſes a cruſhing of the ſolid parts (*vide* §. 322.) it is added in the definition, That the diſorder is called a fracture, when the parts of a bone are ſeparated into *large fragments*. But notwithſtanding this, the ancients refer a comminution of a bone into very ſmall fragments, to the head of *Fractures*, provided it aroſe from ſome external violence; and ſuch a ſpecies of fracture they called αλφιτιδον [d].

§. 340. WHICH diviſion of the bone being ſingle, and by itſelf, denominates the fracture *ſimple*: but when there are ſeveral diviſions of the bone, it is a *compound* fracture; or if accompanied with a wound, contuſion, inflammation, ulcer, or many fragments, it is then called a *complicated* fracture.

Surgeons uſually diſtinguiſh fractures into three ſpecies, *viz. ſimple*, *compound*, and *complicated*. A *ſimple* fracture is ſaid to be when a ſingle bone is only fractured in one place, without any conſiderable hurt of the incumbent or adjacent parts. But when ſuch a fracture happens in any part of the body where two large bones lie by the ſide of each other, as for example in the cubitus; if the radius only is fractured, without injuring the ulna, that ſpecies of fracture is then termed *incomplete*, by ſome ſurgeons, becauſe the ſituation of the parts is not then much diſturbed, and the limb retains its proper length: but when the ulna and radius are both fractured together, or the tibia and fibula in the leg, they then call the fracture *complete*, or even *compound*;

[d] Lib. vi. cap. 89. p. 66. verſa.

pound; though it would alſo ſeem that a fracture may be termed *compound*, when only a ſingle bone is fractured in ſeveral places. But when a fracture of one or more bones is attended with ſymptoms that require a diſtinct treatment, ſuch as a wound, ulcer, *&c.* it is then termed *complicated;* becauſe a particular regard muſt be then had to thoſe concomitant diſorders, during the cure of the fracture. But it is very evident, that a fracture ought not to be termed *complicated*, unleſs thoſe ſymptoms are very ſevere; for no fracture can be made without ſome degree of contuſion, and a ſlight inflammation almoſt conſtantly attends a fracture. Hence it follows, that a fracture is only to be termed *complicated*, when thoſe concomitant diſorders are ſo conſiderable, as to require a diſtinct treatment, or a method of cure different from that which is ſufficient in a ſimple or a compound fracture: As, for example, when a fracture is accompanied with a large wound, the ſame bandage cannot be applied as in a ſimple fracture, where the dreſſings may continue upon the part for ſeveral weeks; but ſuch an apparatus is required as may be eaſily removed, for the dreſſing of the wound, without hazarding a freſh diviſion of the fractured and reduced bone.

§. 341. NOW, according to the different courſe of the fracture, it is alſo termed, either Tranſverſe, Oblique, or Longitudinal; and according to the fragments, pointing againſt, or preſſing laterally upon, each other, and according to the protuberant ſpines that ariſe, the fracture takes a different name and method of cure, as it acquires a different nature.

Fractures, again, acquire different names according to their different courſe or ſituation. A *tranſverſe* fracture is when the bone is divided in a direction perpendicular to its length, being that ſpecies of fracture which our ſurgeons in Holland call *radſbreuk*, or a breaking-ſhort off like a ſtick: and the like term we alſo meet

with among the ancient Greeks, taken from the similitude of a broken ſtick or ſtalk, *viz.* καυληδον καταγμα [a]; namely, where the parts of the bone tranſverſely fractured, entirely depart from each other, without any further coheſion. Hence this kind of fracture is alſo termed ραφανηδον and σικυηδον by Ægineta [b], from the ſimilitude of a broken radiſh or cucumber. Hence alſo Hippocrates [c] ſeems to have uſed in the ſame ſenſe the word αποκαυλισθηναι, where he ſays, ην δε καταγη η κατω γναθος, ην μη αποκαυλισθη πανταπασιν, αλλα ξυνεχηται το οστεον, &c. *Si vero inferior maxilla frangatur, nec autem omnino tranſverſim fracta fuerit, ſed cohæreat os, &c.* "But if the lower jaw "is fractured, the fracture not being quite tranſverſe, "but the bone yet adheres, *&c.*" where it manifeſtly appears, that το αποκαυλισθεν is uſed in oppoſition to τω συνεχει.

Oblique.] That is, when the diviſion of the bone is not perpendicular to its length, but inclined either to one ſide or the other; by which means the fracture acquires a larger ſurface, and the fragments are more difficultly retained together after they have been reduced.

Longitudinal.] That is, when the bone is ſplit according to its length: whence it may be rather termed a fiſſure than a fracture; becauſe the parts of the affected bone are in this caſe ſeldom entirely ſeparated from each other, but remain ſlit as it were in a right line; which ſpecies of fracture is therefore called by the ancients χιδακηδον [d], or a diviſion of the bone according to its length [e].

According as the fragments, *&c.*] For the fractured extremities of a bone may either continue in their natural ſituation, eſpecially when the fracture is tranſverſe: or elſe they may be a little diſplaced, ſo, however, as to remain partly in contact with each other: or, laſtly, the fragments may be wholly ſeparated from each other, and recede to either ſide; which is almoſt conſtantly the caſe in oblique fractures, and ſometimes alſo in tranſverſe: But if the fragments are alſo ſharp-pointed,

[a] Galen. Method. Medendi, lib. vi. cap. 5. Charter. Tom. X. p. 143. [b] Lib. vi. cap. 89. p. 96. verſa. [c] De Articulis, textu 25. Charter. Tom. XII. p. 342. [d] Galen de Method. Medend. lib. vi. cap. 5. Charter. Tom. X. p. 143. [e] Egineta, lib. vi. cap. 89. p. 96. verſa.

pointed, they may run through the integuments like thorns; which is certainly the worſt ſpecies of fractures.

Now, it is neceſſary to attend carefully to all theſe different circumſtances, not only for diſtinguiſhing fractures by their different names, but becauſe their different nature requires a different treatment, and becauſe a better prognoſis may be thence formed of the bad conſequences which may be expected to follow.

§. 342. THE effects of a fracture are different, according to the particular nature of the fractured bone, and the different manner in which the fracture is made; with the various condition of the fragments, as to their ſituation, figure, number, magnitude, *&c.*; and, laſtly, according to the different nature of the adjacent parts, and of the part itſelf, in which the fracture happens.

The firſt conſequence of a fracture, is a diſorder of all the functions which reſulted from the continuity of the bone; and then follows a diſturbance in the actions of the adjacent parts, which are either compreſſed or injured by the boney fragments. Hence it is very evident, that a great variety of ſymptoms may follow from a fracture as the cauſe; and the difference of theſe ſymptoms will depend on

The particular nature of the fractured bone.] As for example, the larger bones, ſuch as the os femoris, os humeri, *&c.* have a cavity in which the medulla is depoſited; but the clavicles, ribs, bones of the carpus and tarſus, have no ſuch cavity full of marrow: whence a fracture of the larger bones muſt be always attended with an injury of the medulla, from which the very worſt conſequences may follow.

The different manner in which the fracture is inflicted.] For a tranſverſe fracture is the beſt, ſince the parts may be mutually applied to each other; but an oblique fracture is worſe, becauſe the extremities of the fractured bone more eaſily depart the one from the other. Whence Hippocrates, in treating of a frac-

ture in the clavicle, obſerves[a], That it may be more eaſily cured, if fractured quite tranſverſely; but more difficultly, if it is broken in a longitudinal direction. The difficulty of the cure will be alſo much augmented, if the fracture is accompanied with a violent contuſion or wound.

Various condition of the fragments as to their ſituation, *&c.*] For when the ends of the bone remain in their proper ſituation in a tranſverſe fracture, they do not injure the adjacent parts; or when they depart a little to either ſide, but in ſuch a manner that the lower end as yet ſuſtains the upper, no very bad conſequences follow. But when the ends of the bone, being removed from their natural ſituation, are forced up by the ſides of each other, they will neceſſarily preſs and injure the adjacent muſcles, tendons, *&c.* and a much greater extenſion will be here required to reduce the fractured ends of the bone to their natural ſituations.

Figure.] For the more acute the fragments, the more will they hurt the adjacent parts; whence Celſus, in treating of the various kinds of fractures, pronounces, *Every bone, therefore, is fractured, ſometimes in a right line, like a piece of wood that is ſplit longitudinally; ſometimes it is broken in two, tranſverſely, and ſometimes obliquely; ſometimes alſo the extremities of it are obtuſe, and ſometimes acute: which laſt is the worſt kind of fracture; becauſe the ends cannot be reduced together, having no ſupport for each other; and becauſe they wound the fleſh, or ſometimes injure the nerves or muſcles*[a].

Number, magnitude.] The more numerous the fragments into which the bone has been ſeparated, ſo much the more danger is there of damage to the adjacent parts, and the more difficult will it be to retain the reduced bones in their natural ſituation: but the larger the fragments, the cure will be (*cæteris paribus*) ſo much the more eaſy.

According

[a] De Articulis, text. 63. Charter. Tom. XII. p. 323.

[b] Omne igitur os, modo rectum, ut lignum in longitudinem findituri modo frangitur tranſverſum: interdum obliquum: atque id ipſum nonnunquam retuſa habet capita, nonnunquam acuta, quod genus peſſimum eſt: quia neque facile committuntur, quæ nulli retuſo innituntur; et carnem vulnerant, interdum quoque nervum aut muſculum. *Lib.* viii. *Cap.* 7. *p.* 524.

According to the different nature of the adjacent parts, or of the part itſelf, *&c.*] The larger bones are very compact in the middle; but at their articulations their ſubſtance is ſpongy or cellular, formed by the departing of the boney lamellæ from each other: if therefore a bone is fractured near its articulation, it muſt of neceſſity deſtroy this cellular fabric; whence a great number of diſorders may follow from the humours there extravaſated and corrupted. But the ligaments which connect the bones to each other, being inſerted near their articulations, they likewiſe will be injured; whence an inflammation of them, and an anchyloſis, may follow. It was ſaid before, at §. 218, n° 6. that a very conſiderable artery enters the tibia through its upper and back part, frequently running for the length of an inch in the midſt of the ſubſtance of the bone itſelf: if therefore a fracture ſhould happen in that part of the bone where the artery enters, a fatal hæmorrhage may follow, if the fracture is alſo accompanied with a wound; or elſe the blood, extravaſated under the entire ſkin, may produce a ſpurious aneuriſm, and all the bad conſequences that may thence follow.

If, again, the fractured parts are within the reach of a conſiderable nerve, artery, or vein, which run near the bone, it is very evident in what danger they are of being compreſſed or injured by the fragments, eſpecially when they are ſharp. Many bad conſequences are alſo to be feared, if the tendons of ſtrong muſcles are inſerted into the part of the bone fractured. All theſe circumſtances are to be conſidered at the firſt dreſſing; and therefore the ſurgeon and phyſician ought not to proceed too haſtily, but to conſider well the nature of the part fractured, and compare it with thoſe excellent tables of Euſtachius: for unleſs the conſequences to be feared are then predicted, they may be afterwards imputed to a miſmanagement of thoſe who are employed in the cure: thus, for example, a fracture of the os humeri near its articulation, by compreſſing or injuring the large nervous trunk there ſeated, may produce a palſy, a loſs of ſenſation, or a withering, *&c.* of the limb, which can be remedied by no means whatever.

Hippocrates alſo diligently inculcates this admonition, in treating of thoſe fractures where the fragments are forced through the ſkin; where he ſays, *But thoſe who have a fracture of the os femoris or os humeri, very difficultly eſcape: for thoſe bones are very large; contain much marrow; and at the ſame time lacerate many and large nerves, blood-veſſels, and muſcles. Even if they are reduced, a convulſion uſually follows; and if they are not reduced, acute and bilious fevers, with hickups,* &c. *enſue. But ſtill thoſe are more likely to eſcape, where the fracture is in the lower part of the bone, than when it is in the upper part,* &c. *The caſe will be alſo much worſe, if the fracture of the os femoris or os humeri turns inward; becauſe many and large veſſels run by the inner ſide of the bone, ſome of which being wounded kill the patient; but along the outer ſide of the bone there are few veſſels placed. In fractures of this kind, therefore, the danger ought to be remembered, and timely predicted* [c]. Thus the worſt conſequences frequently follow after a fracture of the ribs, when the fragments lacerate the pleura, or even ſometimes wound the lungs themſelves; whence an empyema and an incurable conſumption thence following. And a fracture of the calcaneum, into which is inſerted the very ſtrong tendon termed Achillis, is often followed with moſt acute and continual fevers, accompanied with a trembling, hickup, and delirium, which deſtroy the patient in a few days [d].

§. 343. THE chief conſequences therefore are, A deſtruction of the office of the bone

[c] Quibus vero femoris vel humeri os exceſſit, fere non evadunt: ſunt enim oſſa hæc magna, et multum medullæ habent, et multa ac magna ſimul lacerantur, nervi, et venæ et muſculi. Quod ſi reponantur, ſolet nervorum diſtenſio ſupervenire; ſi non reponantur, febres acutæ et biliosæ, et ſingultuoſæ. *&c.* Magis adhuc evadunt, quibus inferior pars oſſis, quam quibus ſuperior exceſſit, *&c.* Multum quoque differt, ſi verſus interiora os brachii vel femoris exceſſerit: multæ enim et magnæ venæ per interiorem partem feruntur, quarum nonnullæ vulneratæ hominem jugulant: per exteriorem vero partem pauciores incedunt. In ejuſmodi ergo læſionibus non oportet obliviſci periculi, illudque in tempore prædicere. *De Fracturis, textu* 47. *Charter. Tom. XII. p.* 257.

[d] Ibid. textu 23. Charter. Tom. XII. p. 201.

bone for ſuſtaining or ſupporting and directing the muſcles; whence a contraction of the muſcles, a diſturbance of them from their proper places, with a ſhortening, diſtortion, and deformity of the limb itſelf; a laceration, contuſion, and corruption of the external and internal perioſteum, of the veſſels themſelves ſeated in the ſpongy part of the bone, and alſo of the medulla with its including fine membrane; a luxuriancy of the veſſels of the bone, whence a rough callous tumour, and deformity of the limb; a diſtraction, laceration, iritation, compreſſion, and convulſion, of the membranes, tendons, and nerves; an obſtruction, inflammation, and deſtruction of the adjacent veſſels; pain, ecchymoſis, withering, ſuppuration, gangrene, and death itſelf, of the part, or of the whole body; but a contuſion almoſt conſtantly attends a fracture.

This aphoriſm enumerates the principal diſorders which uſually follow after fractures of the bones.

A deſtruction of the office of ſupporting.] When we either ſtand or walk, the whole weight of our body is ſuſtained by the bones of the thighs and legs; whence it is, that theſe bones, being too flexible in rickety children, are incurvated by the incumbent weight of the body. When therefore the continuity of the bone is removed by a fracture, this office of ſuſtaining the body is immediately taken away; unleſs the fracture ſhould happen to be tranſverſe, ſo that the ends of the bone, as yet retaining their natural places, are ſuſtained the one upon the other: but if, in ſuch a caſe, the perſon walks, or moves the fractured parts, the ends of the bone will ſoon after be removed from their contact, and be incapable of ſuſtaining the weight of the body. Parey[a] being ſtruck by the kick of a horſe, fell down in his endeavouring to avoid farther injury; and

[a] Livre xv. chap. 23. p. 344.

and both bones of his left leg being fractured, not only forced themſelves through the ſkin by the preſſure which they received from the incumbent weight of the body, but alſo perforated the boot itſelf, with intolerable pain.

Of ſuſtaining and directing the muſcles.] Moſt of the muſcles in the body ariſe from, and are inſerted into, the bones; ſo that, if we except the ſphincters, and muſcular fibres of the veſſels and viſcera, we ſhall ſcarce find any muſcle but what has one end of it faſtened to ſome bone. The bones therefore being fractured, the action and direction of the muſcles faſtened to thoſe bones will be deſtroyed, or wonderfully perverted. When the patella is fractured, to which adhere the tendons of the muſcles extending the leg, the direction and action of thoſe muſcles is then immediately diſturbed, being deprived of that ſupport which elevated and ſuſtained their tendons. The ſame is alſo true of the other bones.

A contraction of the muſcles, and a ſhortening of the limb.] Galen [b] had in his time obſerved, that the muſcles poſſeſſed a natural power of contracting themſelves; and that this contraction did not proceed from the faculty of the mind which moves the muſcles, he proves by an experiment, *viz.* That a muſcle tranſverſely divided appears to contract itſelf towards each end, even after death. Veſalius [c] has beautifully confirmed the ſame thing by experiments made on living animals. For when he totally divided the belly of a muſcle, he obſerved that one part of the muſcle contracted itſelf towards its origin, and the other part towards its inſertion: and upon dividing the tendon of another muſcle, he perceived that the muſcle contracted towards its origin; or if he divided the head of the muſcle, it contracted towards its inſertion: but when he divided the muſcle both at its origin and inſertion, it then contracted towards its belly, and became globular in that part which was moſt fleſhy. But it is the bones, to which the muſcles are attached, that maintain them in this diſtenſion: ſo that when a bone is

[b] De Motu Muſculorum, Lib. i. cap. 8. Charter. Tom. V. p. 376.
[c] Lib. vii. cap. 19. p. 568.

s broken, the muſcles become ſhorter by a ſpontaneous contraction, and draw up that part of the bone into which they are inſerted; whence the limb becomes ſhorter, in proportion as the muſcles inſerted into the lower fragment of the bone are more ſtrong and numerous. Thus if the os humeri is fractured above the place into which the deltoide muſcle is inſerted, it will be then contracted very ſtrongly upwards; whence the arm will become ſhorter: for, as Celſus [d] obſerves, the nerves and muſcles, which were kept in a ſtate of tenſion by the bones, are now contracted. The ſame is alſo true of a fracture in the os femoris. Whence it is unanimouſly allowed, by the conſent of all ſurgeons, that a fracture in the upper part of the thigh-bone, near the hip, is ſeldom curable, without leaving ſome defect in the motion of the limb; but when the ſame bone is fractured in the middle, or towards the knee, there are much greater hopes of obtaining a cure. This ſeems to follow, becauſe the higher the fracture of the femur, the greater number of muſcles draw up the lower part of the bone; and as thoſe muſcles are very ſtrong, they require a very forcible extenſion, in order to replace the fragments, which are then alſo very difficultly retained in contact.

A diſturbance of the muſcles from their proper ſeats.] Moſt of the muſcles ariſe from and are inſerted into the bones, and frequently adhere to them for a very conſiderable length: If therefore a fractured bone ſhould happen to be diſplaced, it will diſturb the ſituation and courſe of the adjacent muſcles which ariſe from or are inſerted into the fractured bone: and beſides this, the fragments of the bones may diſturb other muſcles which neither ariſe from nor are inſerted into the bone fractured; inaſmuch as the fragments will expel and diſplace all the circumjacent ſoft parts, which cannot be performed without a diſturbance of the muſcles; whence will follow

A diſtortion and deformity of the limb.] The external ſurface of the human body is beſet with various eminences and excavations, which ariſe principally from

[d] Lib. viii. cap. 10. p. 532.

from the muſcles variouſly placed, and being either contracted or relaxed; which is more eſpecially obvious in robuſt men who are not over fat: but in women they are leſs conſpicuous, whoſe bodies are therefore always more ſmooth and even. This is very well expreſſed by the painters and ſtatuaries, when they repreſent the bodies of Hercules or Laomedon with ſtrong arms, or the body of Venus ſmooth and uniform. So ſoon therefore as the muſcles are diſplaced by the fracture of a bone, the figure of the parts is altered, and the natural ſhape of the limb is deſtroyed. Hence it is that ſkilful ſurgeons compare, for example, the arm or leg which was broken, with the arm or leg of the ſound ſide; and, by a ſtrict attention, they obſerve whether both limbs have the ſame eminences and excavations, in order to determine whether the fractured bone is properly reduced. For the fragments of a bone, for example, of the humerus, may be adapted to each other, and cohere together, though they are not replaced in the ſame poſture which they had naturally before; but then the deformity of the limb, in this caſe, will always demonſtrate the error. The greateſt deformity of this kind may follow after a fracture in the bones of the cubitus; for then the ſupinator and pronator muſcles of the hand commonly alter the natural figure of the parts in a ſurpriſing manner.

We come now to the diſorders which happen to the bones themſelves, after a fracture.

Of the external perioſteum, the veſſels running betwixt the boney cells, the internal perioſteum, the membranes of the medulla, *&c.*] All the bones are inveſted with a membrane, which conveys veſſels to and from the ſubſtance of each bone, and which is termed the *perioſteum*, generally adhering very ſtrictly to the bones. This membrane covers the external ſurface of the bones on all ſides, except in thoſe places where the ligaments ariſe from the bones to encompaſs and ſecure the articulations: for in theſe places the prioſteum departs from the bone, and continues to run on over the ligaments, till it is inſerted into and conjoined with the next bone; and in this manner does the perioſteum paſs

aſs from one bone to another, without any interrup-
on of its continuity [c]. The whole ſurface therefore
f all the bones is covered with the perioſteum, excep-
ng thoſe parts which are contained in the capſule of
ach joint, formed by the ambient ligaments of each
rticulation. But it very rarely, if ever, happens, that
ne bones are broke within theſe ligamentary capſules;
herefore a fracture of the bone muſt always injure the
xternal perioſteum. Add to this, that we meet with
very ſurpriſing cellular fabric in many of the bones;
nd the ſmaller bones which have no large cavity filled
ith marrow, ſuch as the bones of the fingers, meta-
arpus, and carpus, *&c.* have their whole ſubſtance
ompoſed of boney cells. But in the larger bones,
hich have a conſiderable cavity in their middle filled
ith the medulla, their lamellæ are very compact and
loſely united in the middle; but towards the ends they
ecede from each other, and form wonderful cells, in
hich the blood-veſſels and veſicles of the medulla are
epoſited. If, therefore, one of theſe larger bones is
actured at its extremities, this cellular fabric will be
eſtroyed, the veſſels will be ruptured, and their juices
xtravaſated; which, by corrupting, may produce a
rain of the worſt conſequences. Hence it is eaſily
pparent, that a fracture of the bone may alſo deſtroy
ne internal perioſteum, with the fine medullary mem-
rane, and the ſubſtance of the medulla itſelf; ſince
neſe are ſo tender, that they break to pieces by a rough
andling with the fingers, even in an old ox. But
hat ſevere maladies may follow from a corruption of
ne medullary oil, we ſhall hereafter declare more at
rge in the Hiſtory of Diſeaſes in the Bones. But cer-
ain it is, that all thoſe parts will be lacerated, if the
nds of the fractured bone recede from each other, or
ide one upon the other; for then all the parts con-
ined within the cavity of the bone muſt be unavoid-
bly lacerated. It is indeed true, that the worſt con-
equences which are to be thence feared do not always
appen after a fracture; but it is evident, that they
ay ſometimes follow: therefore it is moſt adviſeable
for

[c] Clopton Havers Oſteologia Nova, p. 17.

for the ſurgeon to acquaint the patient, or rather his friends, that ſuch accidents may happen; by which means he will prevent them from being aſcribed to any want of ſkill or care in himſelf.

A luxuriancy of the veſſels of the bone, whence an inequality of the callus, with a tumour and deformity of the limb.] In the Prænotiones Coacæ of Hippocrates we meet with the following ſentence: *Quodcunque os in corpore reſectum fuerit, aut cartilago, non augetur;* "Whatever bone or cartilage in the body is divided, "it will not grow or be nouriſhed [h]:" and in the Aphoriſms he ſubjoins alſo, *Nec coaleſcit;* "that it will not "unite or coaleſce [i]." After him Galen has alſo pronounced, that a bone can never unite with bone, nor cartilage with cartilage; for in a fractured bone there is an union of the parts by the intervention of a growing callus like glue, but not by a concretion of the divided parts themſelves [k]. But in his firſt commentary which he has written upon Hippocrates concerning fractures, he has explained this matter more at large, where he ſays, *As the bones by their natural dryneſs cannot grow together like fleſh, therefore a callus growing round the margin of the fracture forms a ſort of vinculum or connection. But the origin of this callus is from the ſuperfluous nouriſhment of the bone itſelf; and when the patient does not uſe a proper regimen, or is of a plethoric habit, that ſuperfluous nouriſhment is very copiouſly diſcharged, ſo as to wet or moiſten all the dreſſings or bandages in the manner of extravaſated blood* [l]. From hence he ſeems to think, that the callus does not ariſe from the proper ſubſtance of the bone itſelf, but that the bone is conjoined by the intervention of a kind of glue betwixt the fragments: for a little afterwards he ſubjoins, That the callus

[h] N° 505. Charter. Tom. VIII. p. 882. [i] Sect. 6. Aphor. 19. Charter. Tom. IX. p. 258. [k] Meth. Med. Lib. v. cap. 7. Charter. Tom. X. p. 113. [l] Quum oſſa ob ſiccitatem naturalem non poſſint carnis inſtar coaleſcere, quaſi vinculum quoddam illorum callus ſit, circumcreſcens fracturæ labiis. Originem vero ei (callo) dat ſuperfluum ipſius oſſis fracti nutrimentum. Et quando decumbens non utitur idonea victus ratione, vel etiam plethoricus eſt, illud ſuperfluum copioſum eſt, effuſumque totas faſcias velut effuſo ſanguine madefacit. *Charter. Tom. XII. p. 179.*

allus is to fractured bones the ſame as glue to pieces f wood united. But ſince it cannot be denied that ne callus in time acquires the ſame hardneſs with the one itſelf, and as Galen did not believe a callus to be apable of putting on the nature of bone, it ſeems ſurriſing when he expreſſes himſelf in the following words: *Whatever then concretes about the margin of the fracture while it tranſudes from thence, the ſame being changed by time, becomes very much like the bone itſelf, and is denominated a callus*[m]. Whence it appears, that he would ave the name of *callus* continued, even after it has acuired the hardneſs of a bone. After Galen, moſt eople ſeem to have been of the ſame opinion. But ve have already ſeen, in the commentaries on §. 158, 9. that the loſt ſubſtance is regenerated in wounds, nd the divided parts united, not by the intervention f glue, but by a true regeneration of the loſt fleſh, ormed by nature from good blood brought to the parts; s Galen himſelf has truly affirmed in the place there ited. It alſo evidently appears in the hiſtory of wounds n the head, that the part of the ſkull which is removed y the wounding inſtrument, or cut out by the trepan, rows up again. The ſame therefore ſeems to take place n fractures of the bones, namely, that they conjoin, ot by the interpoſition of any glue, but by a ſubſtance ruly their own: and in thoſe caſes where part of the one is removed, there is not a thick humour interpoed betwixt the fragments, which gradually hardens; ut the organical fabric of the bone itſelf is reproduced, nd repairs the loſt ſubſtance. This truth is very well onfirmed by chirurgical obſervations. A man had the bia and fibula fractured by the wheels of a loaded cart aſſing over his leg, which lacerated all the adjacent arts in ſuch a manner that nothing leſs than an amutation of the limb could be thought of. But the agments of the bones being replaced, and proper eans uſed, the fibula was perfectly united after two onths time: but a conſiderable fragment of the tibia

[m] Quidquid igitur ex eo, dum effunditur, circa fracturæ labia concreit, illud, tempore mutatum ab oſſe contiguo, illi ſimillimum fit, et callus nominatur.

was ſeparated to the length of four fingers breadth, in which the groove of the medullary cavity was conſpicuous; ſo that a large hiatus or ſpace was left betwixt the two ends of the fractured tibia. Yet this whole ſpace was in ten months time filled with a ſubſtance ſo compact and firm, that the man could afterwards commodiouſly uſe his leg [n]. Now, does it ſeem credible, that a glue, ariſing from the ſuperfluous nouriſhment of the bone, and tranſuding from its own fractured extremities, could thus elongate the bone exactly, without any deviation, ſo as to fill up ſo large a ſpace? Ought not this to be rather aſcribed to that wonderful property received by the human body from its adorable Creator, by which it is able to reſtore the loſs of ſubſtance, and increaſe the dimenſions of all its parts already formed, by changing its aliments into its own nature through the action of the veſſels and viſcera? Certain it is, that the vital rudiment concealed in the facculus of colliquamentum in a fecundated egg, does in the ſpace of one and twenty days build up the whole created fabric of its little body, and forms ſuch ſolid bones from the ſoft albumen, as not only enables the chick to ſtand, but alſo to run about, ſoon after it is hatched. The ſame mechaniſm therefore ſeems to take place in the bones, with reſpect to the reproduction of their loſt ſubſtance, and their concretion after a fracture, as we obſerve to happen in wounds of the ſoft parts; namely, that there is an organical reproduction of the loſt ſubſtance, and a true concretion, without any agglutination by the interpoſition of a ſhapeleſs glue.

Now as in wounds of the ſoft parts the repullulating veſſels, which are ſo minute and ſoft, may be too much diſtended for want of the confining ſkin, ſo as to degenerate into a fungous fleſh; the ſame is alſo true with reſpect to the callus of a bone, which may be luxuriant in the ſame manner, if the juices are diſcharged too copiouſly, or if the veſſels are too forcibly diſtended beyond what is neceſſary for reproducing the ſubſtance

[n] Traite complet de Chirurgie, par M. de la Motte, &c. Tom. IV. p. 284, &c.

ubſtance of the bone: and this is more eſpecially to be feared in younger ſubjects, whoſe ſolids are always more weak and infirm, and their fluids more redundant, and generally move with a quicker circulation; whence it is that ſurgeons have ſo often obſerved a luxuriancy of the callus in young patients, eſpecially after uſing a plentiful diet. This accident muſt be neceſſarily attended with an equality and alteration in the figure of the part. But the deformity of a limb happens ſtill more frequently, when the two ends of the fractured bone are preſſed againſt each other before the callus has acquired ſufficient firmneſs; for then the callus is preſſed out on all ſides like ſoft wax, and forms a protuberant ring round the fractured part of the bone: Which alſo more eſpecially happens when the patient walks too ſoon upon the fractured bones either of the legs or thighs; for the weight of the body preſſing on the bones, forces out the callus, if it has not yet acquired its boney hardneſs.

A diſtraction and laceration of the membranes, tendons, and nerves.] Theſe more eſpecially follow, when the ends of the bones ride over each other; and ſtill more if the ends of the fragments are ſharp-pointed, for then they prick and lacerate all the circumjacent parts. It has been obſerved under the preſent aphoriſm, that when Parey had the misfortune of his leg broken while ſtanding on it, the fragments of the bone not only pierced through the ſkin and muſcles, but even through the boot alſo, with intolerable pain. But what dangerous conſequences are to be feared from the membranes, tendons, and nerves being injured or irritated, has been already ſaid in the commentaries on §. 162 to 166, and 181 to 185. Such lamentable conſequences ſometimes follow in theſe caſes, that Hippocrates adviſes the phyſician to avoid them, when he can do it without prejudice; ſince there are here but ſmall hopes, and the greateſt danger: For (ſays he) if the bones are not replaced, the phyſician will ſeem incapable of his art; and if they are replaced, the patient will be advanced nearer to death than recovery [o].

[o] De fracturis, text. 50. Charter. Tom. XII. p. 259.

An alteration and deſtruction of the adjacent veſſels.] The worſt accidents that uſually follow fractures, ſeldom proceed from the injury of the bone itſelf, but rather from the hurt ſuffered by the adjacent ſoft parts, which are compreſſed or wounded by the boney fragments. Great numbers of veſſels are then injured, which are either ſeated in the ſubſtance of the bone, or the adjacent parts liable to be compreſſed by the diſplaced fragments; whence Hippocrates obſerves, (as we ſaid under the preceding aphoriſm), that it is of great moment to know, whether the bones of the arms and thighs are diſplaced inwards or outwards, becauſe many and large veſſels run along the inner ſides of thoſe bones. Among the cauſes of obſtruction (§. 112.) we enumerated every thing capable of rendering the flexible canals narrower by an external compreſſure or extenſion; it is therefore evident, that obſtructions muſt frequently follow fractures of the bones. And though the courſe of the humours through the narrow veſſels be not totally intercepted, yet many of the functions of the body may be thence ſurpriſingly diſturbed various ways; ſince the due performance of thoſe functions reſult in a great meaſure from the juſt proportion of amplitude which the trunks and branches of the veſſels have with reſpect to each other. If, now, to an obſtruction of the veſſels we add an increaſed circulation of the humours ariſing from a fever, an inflammation will be formed, which may produce all its conſequences, as ſuppuration, gangrene, ſphacelus, *&c.* The ſevere pains alſo in fractures ariſe, not ſo much from the injury of the bone, as from the great diſtraction of the membranes, tendons, or nerves; as may in a great meaſure appear from the entire ceſſation, or great diminution at leaſt, of the pains, after the bones have been reduced into their natural ſituations. When veſſels are divided under the entire ſkin, or but ſlightly wounded, the blood eſcapes; and, being collected in the panniculus adipoſus, forms an ecchymoſis, as we obſerved in the Hiſtory of Contuſions. But when the trunk of a large artery or nerve, deſcending to the ſubjacent parts, is ſo compreſſed or injured that it can no longer

onger tranſmit any thing, the ſubjacent parts are then eprived of all vital influx, and are either corrupted vith a gangrene, or are ſlowly dried up and withered; s appears from the remarkable caſe we related of the nan who had the trunk of the axillary artery totally di-ided, whence his arm remained ever afterwards dried p like a mummy. See the comment on §. 161.

But death ſometimes follows fractures of the bones, rom the excruciating pains, ſevere fever, delirium, onvulſions, *&c.*: Or if a gangrene invades the injured art, which, turning to a ſphacelus, aſcends to the ſu-erior parts; then, after reſtleſſneſs, delirium, ſyncope, ickups, *&c.* the patient at laſt expires in a placid ſleep.

Almoſt conſtantly a contuſion.] For the external vio-ence cannot diſſolve the continuity of the bone, unleſs t alſo acts upon the ſoft parts incumbent on the bone; nd theſe ſoft parts being preſſed betwixt the hard bone nd the injuring cauſe, muſt neceſſarily be contuſed. There will be therefore always ſome contuſion in every racture, unleſs the bones become ſo friable by the ve-nereal diſeaſe, the rickets, ſcurvy, or the like, that they nay be fractured by a very ſlight force. But this is a ymptom that ought always to be well conſidered in ractures; for there are many bad conſequences which riſe from the contuſion, even after the bone has been happily replaced: whence Hippocrates (enumerating many of the accidents which follow uſually from frac-ures and luxations) lays it down for a general axiom, That more is to be feared from the contuſion, than rom the fracture itſelf. For, (ſays he) the ſymptoms re all of them ſlighter when the bone is broken by the orce, than when it remains whole: for the conſider-ble veſſels and nerves are cruſhed in thoſe places where he injury is received; and this contuſion, accompa-nied with a continual fever, hurries the patient to his nd ſooner than a fracture [p]. Therefore thoſe reme-lies are often neceſſary to be uſed, in fractures, which re proper in the cure of contuſions. For though the uſt replacing of the fragments, and the retention of hem in their proper places, ſeem to ſatisfy the firſt or

[p] Textu 62. Charter. Tom. XII. p. 268.

general intention, and may appear of themſelves ſufficient in the judgment of many ſurgeons; yet it is very apparent, from what we have before ſaid, that a different method of treatment will be required according to the various accidents which accompany the fracture.

§. 344. FROM a conſideration of all which (342, 343), we are informed of the exiſtence and nature of a compound fracture: To which if we add, the examination of the fragments by the touch; their crackling, or grating againſt each other, ſenſible to the ear; the deformity and immobility of the limb, evident to the eye; with a knowledge of the cauſe, its degree of violence, and the manner of its acting, or whether it was aſſiſted by the winter's cold, a decrepid old age, or a morbid temperature; from conſidering all theſe at the ſame time, the diagnoſis of the fracture will be ſtill more evident.

This aphoriſm deſcribes thoſe ſigns by which a preſent fracture may be diſcovered. For there are ſometimes accidents of this nature, in diſcovering which the moſt ſkilful ſurgeon may find much difficulty. Moſt places are furniſhed with a ſet of people who call themſelves Bone-ſetters; who, though they are for the moſt part very ignorant, endeavour to perſuade the common people, that they underſtand the art of reſtoring fractured or diſlocated limbs even better than the ſurgeons themſelves. Theſe generally lay the fault of almoſt all diſorders of the limbs either to fractures or luxations, and have immediate recourſe to the application of the whole apparatus uſual in thoſe accidents; by which means they often defraud the patient, and hinder him from his buſineſs without any real neceſſity. By theſe impoſitions they conceal their ignorance, and make thoſe who are unſkilled in theſe matters believe they have performed wonders. But it is the buſineſs of a prudent and honeſt perſon, to uſe his utmoſt endeavours to know whether there is any real fracture or not.

not. The diagnosis of a fracture is indeed easy, when the fragments of the bone are removed from their places, and run up by the sides of each other, or force themselves through the skin: but when they remain contiguous, or are so little displaced, that they sustain each other, and the fractured bone itself is covered on all sides with strong muscles, as in the thigh; the fracture in that case is much more difficult to discover. The same difficulty is likewise frequently observed in discovering a fracture in the cubitus or leg, when only one of the two bones seated in those limbs happens to be broken; as also when the surgeon is called later than he ought to have been, and finds the parts already violently inflamed and swelled. A very skilful surgeon[a] ingenuously confesses, that he was a long time doubtful in a case of this nature, before he discovered that there was any real fracture. A certain man, in jumping over a ditch, broke his leg; and the accident happening at a distance from any person, the patient was obliged to creep a long time on his hands and knees before he could cry out and make any body hear him: at length some country-men came running to him, and carried him home; where the limb was found so greatly swelled by the excess of pain, that the surgeon was obliged to repeat his examination several times before he could discover that there was a fracture, which happened to be a transverse one of both bones, at about the distance of an inch from the ankles. The circumjacent parts here, being very much inflamed, swelled, and tense, retained the bones in their proper situations; whence the difficulty of discovering this fracture chiefly resulted.

That species of fracture, therefore, is the most difficult of any to discover, in which the bones as yet retain their places, so as to sustain each other: in which case, being ignorant of their position, the surgeon very often displaces the fragments from their contacts, by agitating the limb; from whence follows a greater injury and compression of the circumjacent parts, which renders the cure more difficult; since in the first case there

[a] M. de la Motte Traite complet de Chirurgie, Tom. IV. p. 248.

there is little or no extenſion of the bones required, to reduce the fragments into their natural places. If therefore any cauſe ſhould injure ſome part of the body, from whoſe forcible and violent action one might reaſonably expect a fracture, the part ought then to be carefully examined before the clothes are taken off, leſt by moving the limb the fractured parts ſhould be diſplaced from their contact with each other, and render the fracture more malignant. In ſuch a caſe, then, let the limb be taken hold of on each ſide the part injured, at a ſmall diſtance from thence; and by a prudent agitation endeavour to diſcern whether there is any grating or rubbing of the bones, or ſhaking of the fragments, perceptible to the ear or touch: and if any thing of this nature is perceived, the clothes are then to be rather cut off than pulled off, to avoid diſplacing the fragments from their mutual contacts. There will be yet much more room to ſuſpect a fracture, even from ſlight cauſes, when the bones themſelves have become very brittle through a decrepid old age; ſince at that time of life the medullary oil begins to be exhauſted, and the bones becoming drier are rendered more brittle. The ſame is alſo true, if the accident ſhould happen in ſeverely cold weather, at which ſeaſon the bones are found by certain experience to be more fragile than at any other time: and we alſo ſee, that not only the bones, but almoſt all other bodies, become more rigid and brittle in a ſevere froſt.

Beſides this, the bones may be alſo changed by diſeaſes, ſo as to become brittle even by the ſlighteſt cauſe. Thus when the venereal diſeaſe has invaded the bones, it has been frequently obſerved that they have broken merely by the weight of the patient's body in getting out of bed. And the like friability of the bones is alſo ſometimes obſerved in the worſt ſpecies of the ſcurvy, rickets, *&c.* There is a ſurpriſing obſervation of this nature related by Hildanus [b], and which was communicated to him by the celebrated phyſician Philibertus Sarazenus. A man of ſixty years of age was troubled with a phlegmatic gout, at the joints of his right ſhoulder

[b] Centur. 2. obſ. 66. p. 139, 140.

der and elbow, which tormented him for near the ſpace of two months, with an obtuſe pain: as he was well in other reſpects, he uſed no remedies, but that of retaining the parts affected at reſt. While this man was endeavouring gently to draw on a glove on the hand of the affected arm, the os humeri broke tranſverſely about four or five fingers breadth below the ſhoulder. Upon removing the dreſſings three days after the bone had been ſet, the phyſician and ſurgeon, who began to be pleaſed with the ſeeming ſucceſs, upon a narrow inſpection found another fracture of the ſame bone, near the elbow; and this they alſo immediately dreſſed with a ſuitable apparatus. But in another epiſtle writ from the ſame phyſician to Hildanus, about ſix months after the accident, there is an account that they had in vain waited two whole months in expectation of a callus to be formed for uniting the bone; and that the man dying afterwards of an inveterate ulcer in his kidneys, they found the os humeri wholly corrupted with a caries. Another caſe of the like nature is alſo related by the ſame author[c]; *viz.* of a woman near ſixty years old, who had her os humeri fractured in bed, without any external violence, while ſhe was endeavouring to raiſe her body and put on a clean ſhift. This fracture was afterward cured by proper aſſiſtance; but when ſhe was about to get up after ſo long a confinement to her bed, the maid aſſiſting to put on her ſtockings, unfortunately broke her right leg tranſverſely. The ſurgeon being called, made a cure likewiſe of this fracture in the uſual manner, without much difficulty. In this manner ſhe ſurvived, ſuffering various fractures, for the ſpace of two years, at the end of which time ſhe expired with excruciating pains. There ſeems to have been nothing of the venereal diſeaſe in this caſe, becauſe the huſband never found himſelf diſordered; and they had ten children in perfect health; nor was there ever any occaſion in the leaſt to ſuſpect the mother's honeſty. Hence it is evident, that a friability of the bones may ſometimes ariſe from latent cauſes, whence they are often fractured by a very ſlight force.

§. 354.

[c] Centur. 2. obſ. 68. p. 141.

§. 345. BUT it is more difficult to diſcover an oblong fracture, till after ſome delay; yet the pain, tumour, thickneſs, and inequality of the part, with the diſcharge of a foul matter, and the known violence of the cauſe, will afford ſome light towards the diſcovery.

A fracture is ſaid to be oblong, when a bone is ſplit according to its length by ſome external violence, like a ſlit in a piece of wood. Such a fracture is very difficultly diſcovered, unleſs it ſhould happen in a part where it lies almoſt naked to the touch, as in the anterior part of the leg, where the os tibiæ lies ſufficiently expoſed throughout its whole length, to be examined by the fingers: but in other parts of the body, a perſon cannot eaſily diſtinguiſh a longitudinal fracture. In reality, the worſt conſequences may follow ſuch a fracture; which conſequences then denote too late that ſuch a fracture is preſent. For, in a bone thus ſplit, the veſſels running thro' its ſubſtance are bruiſed, and their juices extravaſated; whence they putrefy, and induce a caries of the bone; or they may alſo inflame and ſuppurate the parts incumbent on the bone. The principal ſigns of ſuch a fracture, if a cauſe ſufficiently violent is known to have preceded, are, the attendance of a deep and laſting pain, with a tumour or elevation of the parts incumbent on the bone, and extending itſelf according to the length of the bone. If after this the integuments break and diſcharge a foul matter, there will be ſtill greater reaſon to ſuſpect that the ſubjacent bone is fractured. But even all theſe ſigns are but doubtful, ſince they frequently follow a violent contuſion, though unaccompanied with any ſuch fracture: it is true, the diſcharge of a foul matter denotes too late that the bone is corrupted; whence the timely diagnoſis of this kind of fracture is very difficult. But even the diſcovery of ſuch a fracture to be preſent, would not conduce much to the benefit of the patient; for what can art perform, in ſuch a caſe, when all the parts retain their ſituations, and only the bone is injured?

red? Some body will perhaps anſwer, that phlebotomy, with diſcutients, antiphlogiſtic fomentations, a thin diet, *&c.* are to be uſed, to prevent an inflammation, ſuppuration, and all their conſequences. But the contuſion which always accompanies this ſort of fracture, will require thoſe means, even though the bone be not injured. In the Hiſtory of Wounds in the Head, we directed how a fiſſure of the ſkull ought to be treated; but then can other bones ſplit longitudinally in that manner be ſafely denudated, ſo as to be either ſcraped away by the raſp, or bored through with many ſmall foramina? If the thigh-bone is known to be thus fractured, who will dare to cut through the ſtrong muſcles which inveſt it, in order to make a way for his hand to the affected bone? This method of cure can be therefore performed in but a few parts of the body, where the bones are only covered with the common integuments; but then in thoſe places it is alſo much more eaſy to diſcover this injury. In the other parts of the body therefore the knowledge of ſuch a kind of fracture muſt be very difficult to obtain; and of no great uſe if known, ſince no other means can be uſed beſides the general remedies proper for all contuſions.

§. 346. THAT the cure will be either eaſy or difficult, quick or ſlow, complete or defective, may be predicted from the figure, ſimplicity, or complication, and age of the fracture; as alſo from the number, figure, and magnitude of the fragments; the particular place of the bone fractured, the adjacent parts injured, with the ſeaſon of the year, and the age and habit of the patient.

This aphoriſm treats concerning the *prognoſis* of fractures; which indicates the bad conſequences to be feared, or the good events to be hoped for. Therefore all the effects of fractures, enumerated in §. 343, are to be here conſidered; and after a ſtrict examination, we may then conclude (from the known nature of the fracture, with an anatomical knowledge of the parts) whether

whether the cure will be eaſy or difficult. Now the cure is ſaid to be eaſy, when it can be performed without any great endeavours of art, and without much trouble to the patient; and it is ſaid to be difficult, when the contrary obtains. In the next place, it ought to be determined whether a long or a ſhort ſpace of time will be neceſſary to reſtore the bone to its due firmneſs and continuity. And, laſtly, it muſt be inquired, whether the cure may be expected to ſucceed ſo well, that the broken limb will recover the ſtrength, form, and action, which it had before; or whether any ſenſible defect will remain after the cure, ſo as either to disfigure the injured limb, or elſe impede or deſtroy its action. But in doing this, great prudence is neceſſary; for generally the remaining defects are imputed to the fault of the ſurgeon, to his great prejudice, if he does not foretel them. For though an honeſt ſurgeon ought not, like a pretending quack, to magnify a ſmall injury, that he may be thought to have done great matters; yet prudence requires of him to mention the bad conſequences to be feared, leſt he ſhould be thought ignorant or incapable in his art. If a ſurgeon who is too fearful, makes a bad preſage in a ſlight caſe, frequently another is called to undertake the cure; and if he ſucceeds, it hurts the character of the former. Nor will it be leſs prejudicial to promiſe a happy cure, and the event happens to be bad. But to form a ſafe prognoſis, attention muſt be given to the following particulars.

Figure of the fracture.] That kind of fracture is of all the beſt, which is termed *tranſverſe* or *raphanoide*; eſpecially if the fragments as yet ſuſtain each other, and are not quite diſplaced. But the cure of an oblique fracture is much more difficult; becauſe in that the fragments do not mutually ſuſtain each other, and they are very eaſily diſplaced or removed from their contacts by the contraction of the muſcles faſtened to the bones, nor is it eaſy ſo to ſecure the parts by bandage as that the fragments ſhall continue in their proper places after they have been reduced. Celſus, treating on fractures, has very well expreſſed this: *Of theſe fractures*, (ſays

(fays he) *the moſt tolerable is the ſimple and tranſverſe; but it is worſe when the fracture is oblique, and when there are fragments; and the worſt of all, when thoſe fragments are ſharp-pointed* [a].

Simplicity or complication.] It is very apparent, that the cure muſt be very difficult when the bone is fractured in ſeveral places; and more ſo, if the fractured places are ſo diſtant from each other, that they cannot be inveſted by one and the ſame apparatus, but each fracture muſt have its particular dreſſings. A remarkable caſe of this nature is given us by Le Motte [b], of a man who broke his leg both towards the ankles and the knee: after both fractures had been dreſſed with a convenient apparatus, the uppermoſt continued well enough; but the lower fracture had ſuch ſevere pains, as made it neceſſary to treat it afterwards with the foliated bandage, in the manner of a compound fracture. But if the fracture is complicated, as well as compound, that is, if it be accompanied with a wound, contuſion, inflammation, *&c.* you will foreſee the cure to be ſtill more difficult.

Age of the fracture.] When the parts of the fractured bone continue in their natural ſituations, there is no great danger to be feared from the long continuance of the fracture; becauſe art can do nothing more in that caſe than prevent, by the application of a ſuitable apparatus, the fragments from being diſplaced. But where the fragments no longer ſuſtain each other, but ride over or ſlip up by the ſides of each other, then the diſtraction and laceration of the parts is the greater in proportion as a longer time has elapſed ſince the fracture: whence enormous pains, inflammation, tumour, *&c.* uſually follow; and in that caſe it is impoſſible to reduce the fracture before thoſe ſymptoms are removed, or in ſome degree mitigated. For if a part thus violently inflamed and ſwelled was to be roughly handled, it would ſoon be invaded with a gangrene; or, from the great ſeverity of the pain, convulſions might

[a] Earum maxime tolerabilis eſt ſimplex, eaque tranſverſa: pejor, ubi obliqua, atque ubi fragmenta: peſſima, ubi eadem acuta ſunt. *Lib.* viii. *cap.* 10. *p.* 530.

[b] Traite Complet de Chirurgie, Tom. IV. p. 254, &c.

follow. But when the bone is expoſed naked in a compound fracture, or if a fragment of the bone ſtarts through the ſkin, in that caſe the cure muſt be expected to ſucceed more ſlowly and difficultly, as the parts have been longer expoſed to the air; becauſe here it is often neceſſary to wait for an exfoliation of the diſeaſed part of the bone; as is evident from what has been ſaid on this ſubject, in the Hiſtory of Wounds of the Head, §. 249, 250.

The number, figure, and magnitude of the fragments.] The more numerous the fragments, the more difficult will it be to retain them in their proper ſituations after they have been reduced; and the difficulty will ſtill be the greater as the fragments are leſs. As for example, if the os humeri is fractured in two places, ſo that a piece of its middle is ſeparated to the length of three fingers breadth; ſuch a fracture, though ever ſo well reduced, would be very difficultly retained in its proper ſituation, ſince the contraction of the muſcles, and the preſſure of the ſplints and bandages, would be very apt to diſplace the fragments. Such a fracture would therefore require a machine capable of retaining the limb in its due extenſion; and as ſuch fractures require the moſt elaborate aſſiſtances of art, they cannot be termed eaſy to cure. In ſuch like fractures, Hippocrates [c] recommends the uſe of two cylinders, or round plates of Turkey leather, like what is uſed by thoſe who are a long time confined in heavy fetters; and in a fracture of the leg, he directs to apply one of them above the ankles, and the other below the knee. Theſe are to be furniſhed with loops on each ſide, of ſingle or double leather; in ſuch a manner that the loops of the upper one may correſpond to thoſe of the lower: he then introduced ſplints of horn of a due length into thoſe loops, which held the leathern plates extended to their due diſtances. Thus did Hippocrates maintain the limb at its due length, and preſerve the fragments from being diſplaced at the ſame time; and in the ſame place he deſcribes at large what more is neceſſary to be obſerved in the application of theſe plates.

But

[c] De Fracturis, textu 29. Charter. Tom. XII. p. 246.

But when the fragments are ſharp-pointed, the caſe is very difficult to cure; becauſe theſe greatly injure the adjacent parts, and are difficultly retained as well as reduced, as we ſaid before in the comment on §. 342. It alſo appears from chirurgical obſervations, that the diviſion of a bone made by a ſharp or cutting inſtrument, cannot be cured in ſo ſhort a ſpace of time as a fracture by a blow with an obtuſe inſtrument; which ſeems indeed wonderful. But the reaſon may perhaps be this, that a common fracture has always ſome eminencies or aſperities, which retain the bones more firmly together after they have been rightly reduced, ſo that they can the better unite; and the fragments are not ſo liable to be moved or rubbed againſt each other in coughing, ſneezing, or the like motions; which attrition would deſtroy the repullulating callus, or at leaſt retard the union of the fractured bone. But when a bone has been divided by a cutting inſtrument, the ſurface of the fragments is ſmoother, and they are more liable to be moved or rubbed againſt each other. There are three or four remarkable caſes, in confirmation of this, to be found in the obſervations of Le Motte [d], who affirms, that an inciſed fracture, even a ſimple one, takes double the time in the cure, that a common or even a bad complicated fracture requires, except thoſe which have ſuſtained a conſiderable loſs of ſubſtance, or a violent contuſion of the bone into ſmall ſplinters.

The part of the bone injured.] It was ſaid in the commentary on §. 342, that fractures have various conſequences, according to the part of the bone that is injured. Celſus enumerating ſome of the effects common to fractures of the arms, thighs, legs, and fingers, ſays, That thoſe are attended with the leaſt danger, which happen in the middle: but the nearer the fracture is to the upper or lower head of the bone, it is ſo much the worſe; for it then occaſions greater pains, and is more difficultly cured [e]. For the larger bones are the hardeſt in their middle; but in their extremi-

[d] Traite Complet de Chirurgie, Tom. IV. p. 303——318.
[e] Lib. viii. cap. 10. p. 530.

ties, which are articulated to the next adjacent bones, they are cellular and friable; and the difficulty is ſtill further augmented there by the adjacent ligaments of the articulations which connect the bones. There is alſo much difference betwixt a fracture in the upper or in the lower end of the bone, as we demonſtrated from the teſtimony of Hippocrates in the commentary on §. 342. Thus Hildanus [f] has obſerved, that if the os femoris is fractured near its articulation with the hip, the fracture can hardly ever be cured without a halting of the limb remaining; but that when the ſame bone is fractured in the middle, or towards the knee, it may be often cured by an expert ſurgeon without any defect remaining. And this he confirms by the teſtimony of many conſiderable authors.

The adjacent parts injured.] Concerning theſe, ſee what has been ſaid in the commentaries on §. 342.

Time or ſeaſon of the year.] Hippocrates [g] has pronounced warmth to be very friendly to fractured bones, eſpecially if they are naked; but cold, he ſays, is an enemy to the bones [h]: therefore the cure of a fracture will (*cæteris paribus*) ſucceed leſs proſperouſly in winter than in ſummer. But in the ſummer-heats there is greater danger of a putrefaction; and therefore a cure may be expected to ſucceed the moſt happily in ſpring and autumn.

Age of the patient.] The nearer a perſon is to the birth, the more ſpeedily does a fractured bone unite; and in extreme old age a fracture either not at all unites, or at beſt but very ſlowly: but in younger ſubjects there is more danger of a luxuriancy of the callus; which makes a middle age ſeem to be the beſt. The eminent ſurgeon Le Motte [i] ingenuouſly confeſſes, that he had twice met with the misfortune of breaking an arm in extracting the fœtus by its legs in difficult births: but then they were eaſily cured by a ſlight apparatus in twelve days time; whereas in adults who are in

[f] Obſerv. Chirurg. cent. 5. obſ. 86. p. 475, 476.
[g] Aphor. 22. ſect. 5. Charter. Tom. IX. p. 207.
[h] Ibid. Aphor. 18. p. 204.
[i] Traite complet de Chirurgie, Tom. IV. p. 171

in health, a fracture requires at leaſt thrice that time to be conſolidated.

Habit or temperature.] All thoſe diſorders which either conſume or corrupt the fat of the body, occaſion fractured bones either not to unite at all, or at leaſt but very ſlowly; and therefore fractures are hardly curable in the worſt ſtages of the venereal and ſcorbutic diſeaſes, and in the rickets, conſumptions, *&c.* as appears from the inſtances which we mentioned in the commentary on §. 344. But there is perhaps ſuch a latent diſpoſition in the habits of ſome people, which prevents the bones from eaſily uniting, even though no remarkable cacochymy or other viſible diſorder attends. The celebrated Ruyſch [k] aſſerts he has met with ſuch a caſe, where the bones would not unite even though all the proper rules of art were obſerved towards obtaining it. And in his Obſervations Anatomical and Chirurgical [l] he relates, that in the body of a man, who was hanged in full health, he found two of the anterior bones of the carpus not yet conjoined, even though they were fractured three years before. I have myſelf ſeen a woman, whoſe arm being broken, was afterwards reduced according to art, but never united, even though ſhe was in the flower of her age; whence it ever after remained flexible in the part where it had been broken, which was yet no great inconvenience to her. It is an obſervation made by Hildanus [m], That the conſolidation of fractured bones ſucceeds very difficultly in women with child; and he relates the caſe of a fracture in the middle of the tibia in a woman who had paſſed the ſeventh month of her pregancy, where the fragments were not united in three and twenty weeks time, and it was not till after the thirtieth week that the cure was compleated. But in this woman the fracture was attended with a conſiderable wound, and ſome fragments of the bone came away; whence it may be perhaps judged, that theſe accidents rendered the cure ſo ſlow and difficult. But he has in another place [n] given a very remarkable hiſtory, which confirms the

k Adverſ. Anatom. decad. 2. nº 2. p. 6.
l Obſ. 4. p. 8.
m Centur. 5. obſ. 87. p. 484.
n Centur. 6. obſ. 68. p. 582.

difficulty of curing fractures in women with child. A woman of quality, of a corpulent and plethoric habit, endeavouring to mount a horſe, broke her left tibia betwixt the knee and the ankle: the fracture was happily reduced the ſame day by Hildanus, who neglected nothing that might forward a ſucceſsful cure; and as no pain, nor any other bad ſymptom appeared, he hoped that the cure might have been compleated within the ſpace of two months. When the fortieth day came, the callus was found ſoft and ſlippery; but as the patient had hitherto ſuckled an infant, ſhe was ordered to wean it; and in a little time after ſhe appeared to be with child, and was happily delivered of an healthy and ſtrong girl ſeven months after the fracture was received. The fractured bones could not be united, during the whole time of pregnancy, by all the means that were tried; even though the lady's impatience and continual complaints of the ſlowneſs of the cure excited Hildanus to uſe the utmoſt diligence and induſtry: Yet within thirty days after her delivery, the callus became firm, and the limb recovered its former uſe and ſoundneſs. Hence he concludes, that nature being fully employed in forming and perfecting the fœtus, in a manner neglected to form a callus. Obſervations of the like nature, in confirmation of this, may be ſeen in the *Miſcellanea Curioſa* [o]. But we are in the ſame place furniſhed with the hiſtory of a woman, who, having broken her left knee-pan in the fifth month of her pregnancy, was nevertheleſs ſo well cured in the ſpace of ſix weeks, that ſhe could walk about the houſe with no great difficulty. Hence, therefore, though it does not ſeem to be an univerſal concluſion that fractures of the bones in women with child will not unite before the birth; yet it ſeems adviſeable in theſe caſes to mention the difficulty beforehand, leſt the ſlowneſs of the cure ſhould be afterwards imputed to ſome fault in the ſurgeon or phyſician.

§. 347. THE cure of a fracture requires, 1. A reſtitution of the parts into their natural

[o] Decur. 1. A. 1. obſ. 25. p. 91.

tural situations by extension and reduction. 2. A retention of them in that position by bandages and machines or instruments. 3. A consolidation of the united and retained fragments by the growing up of a callus.

We have here the general method of cure common to all fractures. But every cure is the producing of such a change in the parts of the living body, as will remove the corporeal effect termed the *disease*, (see the comment on §. 4.) and likewise restore that whose absence produced the disease. Now, in a fracture, there is always a removal of the continuity of the bone, and generally a change in the natural situation of its parts: whence it evidently follows, that the cure will require first a restitution of the divided parts to their natural situations, and then a consolidation or union of them; both which may be obtained by the means described in the three numbers of this aphorism.

1. When the situation of the parts has been altered, an extension is always required before the fragments of the bones can be safely reduced. For the surfaces of the fragments are generally rough and unequal; whence, if the reduction was to be attempted without an extension, the fragments would grate against each other, and break off some splinters or asperities, which, interposing betwixt the fragments, would either retard their consolidation, or, being thrust out into the adjacent soft parts, would irritate and injure the membranes, tendons, *&c.* as Fabricius Aquapendente has very well observed [a]. Add to this, that the muscles contract themselves (as we mentioned in the comment on §. 343.) so soon as the cohesion of the bone which directs and sustains them is removed; whence an extension of them appears to be necessary before the fragments can be replaced.

2. After the bones have been reduced to their natural situations, that alone would suffice, if the part could be retained without motion by the influence of the will: but as there are frequently very considerable commo-

tions

[a] Oper. Chirurg. lib. iv. De Fracturis, cap. 3. p. 328.

tions produced in the body, either without the patient's knowledge, as in ſleep; or without his inclination, as in ſneezing, coughing, laughing, *&c.* by which means the replaced bones might eaſily be diſturbed from their ſituations; therefore bandages, compreſſes, ſplints, and other machines, are required, according to the nature of the part injured, to retain the limb firm and immoveable. It is frequent with many patients, for the firſt two or three nights after the fracture is reduced, to pull up the affected limb ſuddenly in their ſleep, in a manner as if it was convulſed; whence they uſually awake in a fright: now, if in ſuch a caſe the limb was not properly ſecured, the reduced fragments would be removed, and require to be replaced again. This is what Parey[b] laments to have happened to himſelf, that while he was ſleeping in the night-time, his broken leg ſo forcibly ſtarted up of a ſudden, that the fragments were diſplaced; whence a new extenſion and reduction was neceſſary, and which were performed with much greater pain than at the firſt time.

3. It was demonſtrated in the commentaries on §. 343, that the fragments united and grew to each other, not by the interpoſition of a glue, which by its coheſion faſtened the ends of the bone together; but by a true union of their ſubſtance, in the ſame manner as, in wounds of the ſoft parts, there is an union of the divided parts and a reproduction of the loſt ſubſtance. From whence it is very apparent, that art can do nothing in this reſpect; but that the nature and fabric of the human body alone performs the whole, while healthy juices are diſtributed in a due quantity, and with a proper force, through their reſpective veſſels to the parts injured. All, therefore, which has been ſaid concerning the regimen and diet proper for the cure of wounds in general, is here applicable. And hence it is, that fractured bones are obſerved to unite ſo ſoon in infants, and ſo very ſlowly or not at all in thoſe of a decrepid old age; becauſe the younger the patient, or the nearer to its birth, the faſter it is obſerved to grow or increaſe. Hence Hippocrates juſtly pronounces, *Some are nouriſhed ſo as*

[b] Livre xv. chap. 25. p. 346.

as to increaſe their body, as well as preſerve it; and others only ſo as to preſerve it, as in old people: ſome again are ſo nouriſhed as to acquire ſtrength alſo [c]. From hence it is ſufficiently evident, that viſcid aliments conduce nothing to the formation of a callus, ſuch as the decoctions of the ſeveral ſorts of corn, and the jellies of animal-ſubſtances, which are recommended by *Fabricius ab Aquapendente* [d]; but that theſe will be rather prejudicial, as they are ſo difficult to digeſt, eſpecially in quieſcent bodies, where they occaſion a ſpontaneous glutinoſity, firſt in the *primæ viæ*, and then in the blood, as we demonſtrated in the commentary on §. 69. Hildanus [e] tells us, he obſerved a man of forty years old, of a good habit, to fall into a cachexy by ſuch a viſcid diet, which was preſcribed to him by an empiric; whence he was afterwards troubled with a jaundice, accompanied with other bad ſymptoms, and at length he periſhed by a dropſy. Nor can we expect the uſe of the ſo much praiſed lapis oſteocolla to conduce any thing more to the formation of a callus, becauſe its hollowneſs and ſimilitude (having a cavity like that in which the medulla is depoſited in the middle of the bones) has made ſome people imagine it a ſpecific medicine for the bones; which it alſo reſembles in its ſpongy texture and friability. It is indeed evident, that this earthy and unactive medicine may be ſafely adminiſtered; but that it has any ſuch efficacy towards the production of a callus, hath not yet appeared. Hildanus [f] indeed extols the virtues of it, and aſcribes to it his happy ſucceſs in the cure of a fracture of both bones of the leg in a man of forty years old of a bad habit; and he alſo aſcribes the too great luxuriancy of a callus to the imprudent uſe of this ſtone in a healthy lad of fourteen years old of a ſanguine habit. But we very well know, that even very bad fractures are happily cured in adults without the uſe of this ſtone; and we

c Aluntur quædam ad incrementum, et ad eſſentiam; quædam ad eſſentiam ſolam, ut ſenes: quædam præterea et ad robur. *De Alimento, text.* 45. *Charter. Tom.* VI. *p.* 193.

d Opera Chirurg. lib. iv. De Fracturis, cap. 6. p. 335.

e Obſerv. Chirurg. cent. 1. obſ. 92. p. 71. Ibid. obſ. 90 & 91.

we alſo know that the callus abounds in younger patients. But though Hildanus aſcribes his happy ſucceſs as above ſolely to the uſe of this ſtone; yet we find that he had recourſe to other more efficacious helps, when he found nature languiſhing in the body of an old patient [g]. A decrepid old man of ſeventy received a compleat fracture of the bones about the carpus by a blow with a ſtick; and many years before he had been troubled with a palſy of the ſame ſide, which was not yet entirely removed. After replacing the fragments, Hildanus being obliged to undertake a long journey, left the reſt of the treatment to his ſervants; but returning again after a month, upon examining the part fractured, he found by the grating of the bones that they were not yet united by a callus. After ordering a very rich and nouriſhing, but not a viſcid, diet, he gave the lapis oſteocolla night and morning with cinnamon; he afterwards daily anointed the arm with a ſtimulating aromatic unguent; and then applied an emplaiſter of the ſame kind, with which ſome lapis oſteocolla was intermixed: by theſe means, in a few days time, there was no grating of the bones to be heard; and the cure was compleated in the ſpace of four weeks. Hildanus would willingly aſcribe the ſucceſs of the cure to the lapis oſteocolla: but in reality the rich diet excited the languiſhing powers, the ſtimulating ointment and aromatic plaiſter procured the juices to flow more effectually and powerfully into the affected parts, and by theſe means conſpiring the cure was compleated. How much may be done towards reſtoring a defective nutrition in any part of the body, by ſuch a ſlight or gentle irritation, has been already obſerved in the commentary on §. 35, n° 3. But when by weakneſs, or from the ill condition of the fracture, thoſe powers which unite the divided parts and regenerate the loſt ſubſtance of the human body are abſent, in vain is the lapis oſteocolla adminiſtered, as is evident even from the teſtimony of Hildanus [k] himſelf. For he candidly confeſſes, that he adminiſtered this ſtone, and applied it

[g] Ibid. cent. 3. obſ. 90. p. 275. [k] Ibid. cent. 5, obſ. 87. p. 484.

it externally, without ſucceſs, in a woman with child; and that, after her delivery, the cure happily ſucceeded. From hence I believe it is ſufficiently apparent, that ſuch remedies may be uſed without harm; but that the regeneration of the loſt ſubſtance, and the reunion of the divided parts, as well in the bones as in the ſoft parts, is to be expected from the nature of the human body only, which is of itſelf ſufficient.

§. 348. IF the fragments retain their proper ſituations, the firſt indication then ceaſes.

If they have receded but a little to either ſide, only a ſmall extenſion is then required.

But if the fragments are ſo diſplaced that they run up by the ſides of each other, a large extenſion is then required in order to remove the intercepted parts, make a ſuitable reduction, and reſtore the whole to its due length.

Retain their ſituations, *&c.*] It ſometimes happens, eſpecially in the winter-time when all bodies are more rigid and brittle, that a bone is ſo fractured by a fall or other accident, that the fragments remain in their natural ſituations; and ſuch a fracture is known chiefly from the preceding cauſe being ſufficiently violent, the pain deep, and a grating or crackling of the bones ſenſible to the ear or hand when each part of the limb is agitated by the two hands. If then no alteration can be obſerved in the figure of the part, upon comparing it with the like part that is ſound, (for the ſituation of the parts may be changed by turning them round, tho' the fragments remain contiguous); it is very evident, that no extenſion nor reduction is then required; only the fragments are to be retained in that ſituation, in order to a cure.

If they recede but a little, *&c.*] A bone is often broken in ſuch a manner that the fragments ſupport each other, and yet form a protuberance on each ſide; or though the fragments remain in contact with each other on all ſides, yet the bones may be ſo twiſted, or drawn

drawn ſide-ways, as to change the ſituation and direction of the parts inſerted into the bones, which will appear from the deformity or altered figure of the limb. No violent extenſion is required in theſe caſes; ſuch alone will be ſufficient, as is capable of ſetting the bones at liberty from touching each other, that they may be reduced to their proper places without any grating of the fragments or ends of the bones.

By the ſides of each other, *&c.*] For then the limb is contracted in its length in proportion as the fragments ride more or leſs over each other; and therefore ſuch an extenſion is here required before the reduction can be made, as will draw the parts a little beyond their natural length, that the fragments may be replaced without rubbing againſt each other, and without intercepting any of the adjacent parts. Whence Celſus obſerves, after deſcribing the ſigns by which ſuch a fracture may be known: *Therefore when this ſort of fracture is diſcovered, the limb muſt be immediately extended: for the nerves and muſcles, which are kept extended by the bones, are then contracted; nor will they recover their ſituation, unleſs they are extended by ſome force* [a]. And afterwards he adds, *But when the extending force has made the limb a little longer than it naturally uſed to be, then it is that the bones muſt be preſſed into their proper places by the hands* [b], &c. Nor is it eaſy to err by making too great an extenſion, eſpecially in fractures of the larger bones: and therefore Hippocrates [c], in treating of a fracture of the thigh-bone, orders a ſtrong extenſion to be made; and adds, that the limb will not be injured, though the extenſion be made larger than neceſſary. And in another place he obſerves [d], that moſt make their extenſion leſs than they ought; but that he had ſeen too violent an extenſion

[a] Ergo, ſi hoc deprenſum eſt, protinus id membrum oportet extendere. Nam nervi muſculique, intenti per oſſa, contrahuntur: neque in ſuum locum veniunt, niſi illos per vim aliquis intendit. *Lib.* viii. *cap.* 10. *p.* 532.

[b] Ubi vero paulo longius, quam naturaliter eſſe ſolet, membrum vis fecit, tunc demum oſſa manibus in ſuam ſedem compellenda ſunt, &c. *Ibid.*

[c] De Fracturis, textu 68. Charter. Tom. XII. p. 222.

[d] Textu 19. ibid. p. 167.

tenſion made on a child. For in the younger age all the parts are ſofter, and a violent extenſion may there force the parts a good deal beyond their natural length: a circumſtance not much to be feared in adults, eſpecially in fractures of the larger bones; for the ſtrong muſcles and tendons in them ſufficiently guard againſt too great a diſtraction of the parts. Add to this, that a ſkilful ſurgeon may diſcover, by feeling the fractured parts with his hands, when the extenſion is made ſufficiently, or whether it is required to be ſtronger. In fractures of this kind, therefore, all ſurgeons order a forcible extenſion; and Parey [e] ſtrongly invited the ſurgeon not to ſpare him when his broken leg was to be ſet, deſiring of him at that time to forget that he was curing a friend. But how violent an extenſion is ſometimes required in difficult caſes, may appear from the following hiſtory. A young man broke the tibia and fibula of his right leg, near the ankle, in ſuch a manner, that the bones forced their extremities for near two inches through the integuments: and in this condition the unfortunate patient lay for ſeven hours before the ſurgeons could attend; whence the limb was by that time very much ſhortened, and a conſiderable tumour formed in the circumjacent parts. This fracture was alſo attended with a conſiderable wound; and the celebrated ſurgeon chiefly concerned owns, that the extenſion was made ſo forcibly in order to replace the fragments, that his aſſiſting ſurgeon often cautioned him not to let the foot be pulled off [f]. But in what maner the extenſion of a broken limb may be conveniently made, and with what precautions, is taught in the following aphoriſm.

§. 349. THE extenſion is performed, 1. By taking firm hold of the bone near the fracture, either with the hands or with ſlings; 2. By firmly ſecuring the patient; 3. By placing the part in its natural poſture; 4. By a ſlow di-

[e] Livre xv. chap. 23. p. 344.
[f] De la Motte Traite complet de Chirurgie, Tom. IV. p. 562, &c.

ſtraction of the fractured parts from each other, in a right line, with ſuch a force as is ſufficient to overcome the contractile power of the muſcles; 5. By the power and application of mechanical inſtruments, if the ſtrength of the hands fail.

1. If nothing forbids, the limb is to be taken hold of by the hands near the place of the fracture; but ſometimes a wound, violent contuſion, or a diſtortion of the muſcles, ſurpriſingly altering the figure of the part, forbid the application of any force to the circumjacent parts of the fracture. But ſince the ſurgeon, who reduces the fragments, cannot at the ſame time make the extenſion of the limb himſelf, except in the leſſer bones, as of the fingers, *&c.* it is therefore neceſſary to have aſſiſtants, who may make the extenſion at the ſame time that he replaces the fragments into their proper ſituations. Therefore the moſt ſkilful ſurgeons, eſpecially in the more dangerous caſes, call in the aſſiſtance of other ſurgeons, who, underſtanding the method of extenſion, know how to perform it as equally as poſſible, which conduces a great deal towards a happy reſtitution of the fragments. But as the part is often required to be kept a conſiderable time extended, before the fractured bones can be duly replaced, therefore thoſe who make the extenſion, ought to be placed ſo, that they may continue in the ſame poſture for a conſiderable time without uneaſineſs, otherwiſe the operation might be interrupted. The beſt method of extenſion is by the hands, becauſe that way the direction is more eaſily perceived and ſooner changed when it deviates from a right line: but if the thickneſs of the limb is ſuch as prevents the hands taking firm hold of it on each ſide, as in a fracture of the thigh-bone; then it is adviſeable to extend the part by ſlings faſtened on each ſide. Hence Celſus obſerves, That to extend a finger, or any other limb that is ſlender, one man may be ſufficient, if he takes hold of one ſide with his right hand, and of the other with his left. A ſtronger limb requires two people, who may pull in oppoſite directions. If the tendons or ligaments are very ſtrong, as in

in robuſt men, and eſpecially if the fracture happens in their thighs or legs, then ſlings or linen bandages are to be tied round the two heads of the bone at its articulations, and to be pulled by ſeveral people in oppoſite directions [a].

2. The reduction of a fractured bone ought never to be attempted, unleſs the patient is retained immoveable either by ligatures or proper aſſiſtants. We ought not in this caſe to truſt to the ſtrength and courage of the patient, ſince the pain is frequently ſo ſevere while the fractured limb is extended, that it may oblige even the ſtrongeſt man to reſiſt and diſturb the operation againſt his will.

3. That is ſaid to be the natural poſture of the part, which it acquires when a man is at reſt, or rather in a ſleep; for then all voluntary motions ceaſe, and the parts of their own accord fall into their natural and moſt eaſy poſture. The joints are then never extended, nor yet inflected but in a ſmall degree. Now while the parts are in this natural poſture, all the muſcles are then the leaſt extended; but if the part is altered from that poſture, even againſt the inclination of the will, then thoſe muſcles will ſwell, which were deſtined to change the poſture of the limb in the ſame manner by the will. Thus, for example, the ſtrong deltoide muſcle elevates the arm; but if the arm be lifted up by any other perſon, the ſame muſcle will appear manifeſtly to ſwell, though not to ſo great a degree as if the arm was raiſed by the influence of the will. But when a broken limb is extended in order to replace the bones, the muſcles muſt be elongated; which may be done with a much leſs force when they are flaccid than when they are ſwelled or turgid. Beſides, if the limb is extended while it does not retain the natural poſture, it will require to be reſtored to its natural poſture after the bones have been replaced, becauſe it cannot continue long in any other poſition without pain; but in doing this the ſituation of the parts will be altered, and the fragments will often be forced again out of their places. This is intended by Hippocates, when he ſays,

[a] Celſus, Lib. xiii. cap. 10. p. 532.

You are to observe, that the limbs remain not straight, but a little inflected, like the hand when it is not in action [b]. And Galen, in his commentary to this text, says, That we are to chuse that posture of the parts in the cure, in which we usually place the limbs when we are at rest. And a little after, describing the natural posture of the hands for example, he adds, That if we consider the posture of the parts in men at rest, it will be found that the hands or arms do not retain an exact medium betwixt flexion and extension, but that they incline a little from extension. But Hippocrates himself says in the beginning of his Book on Fractures [c], (having first observed, that the extension both in fractures and luxations ought to be made as nearly as possible in a right line,) *Plerumque nihil peccare illos, qui nihil prævio consilio faciunt; ipse enim deligandus manum porrigit, ita coactus a justa natura: solos autem illos peccare, qui sibi plus sapere videntur:* Meaning, That, in this case, those generally avoid error who proceed entirely without rule; for the patient himself, directed by nature, will stretch out his hand in the propereſt manner: but those alone offend who, thinking themselves wiser than nature, pretend to assist her with rules of their own. He afterwards, in a very ample manner, disapproves of the opinion of those who bind up the hand and fore-arm in a prone posture; and he blames those still more, who prefer a deligation of these parts in a supine posture, which is much more inconvenient than the former. He then well observes, that while some bind up those parts extended, they often excite pains and other accidents worse than the injury itself; and when they order the patient to bend the joints afterwards, neither the bones, tendons, nor muscles, are any longer retained in their proper situations, but the resistance of the bandage being overcome, they are removed out of their places. And in another place, treating of a fracture in the arm, he says, *But if any one extends the arm, and binds it up in the same posture, the muscles of the arm will be bound together in a state of tension; but when the patient, who has*

[b] Ex quiescente vero ac remissa rectitudines (ἰθυωρίαι) spectandæ sunt velut in manu. *De Medici Officina, textu* 21. *Charter. Tom. XII. p.* 87, 88.

[c] Charter. Tom. XII. p. 153, &c.

has been thus treated, endeavours afterwards to bend his elbow, the muſcles of the arm will acquire a poſture different from their natural one [d]. It is therefore evident, how important this rule is in the cure of fractures. Thus, for example, the natural poſture of the os humeri is parallel to the trunk of the body, when none of its muſcles are in action; and therefore, in a fracture of that bone, the limb ought to be retained in that poſture during the extenſion. If the bones of the cubitus ſhould be fractured, the limb ſhould be a little inflected at the elbow, and the hand retained in a poſition betwixt pronneſs and ſupination. The like is alſo true of the other limbs.

4. Haſtineſs is always prejudicial here; ſince it is required to reſtore the diſplaced fragments of the bone to their proper ſituations without offering further injury to the adjacent ſoft parts within their contacts. But unleſs the extenſion be made in a right line, the fragment will offer a greater injury to the adjacent parts. But this extenſion ought to be made ſlowly or gradually; becauſe the contracted muſcles, which are often contorted or diſplaced at the ſame time, cannot be violently elongated all on a ſudden without danger of throwing them into convulſions. Therefore the extenſion of the fractured limb ought to be very gradually and equably increaſed; by which means the contracted parts may be the moſt ſafely elongated. Hence Hippocrates [e] directs, in ſetting a fracture of the humerus, to ſuſpend almoſt the whole weight of the patient, by placing a board or ſome other ſupport under the armpit; or at leaſt to make the ſuſpenſion of ſuch a degree as will not allow the patient to ſit: and then the cubitus being bent ſo as to form a right angle with the os humeri, is to have a ſoft ſtrap faſtened round it, to which a heavy weight muſt be appended, in order to make a moderate extenſion of the limb. He afterwards adds, that a ſtrong man may ſupply the place of the

[d] Si autem quis brachium extendens in illa poſitura deliget, brachii muſculus tenſus alligabitur; poſtea autem, ubi ſic deligatus cubitum flexerit, muſculus brachii aliam poſituram habebit. *Ibid. p.* 88.

[e] De Fractur. textu 3. Charter. Tom. XII. p. 189.

weight, by pulling the affected parts downwards. But it is very evident that a man, in pulling or extending the limb, ought as much as poſſible to imitate that equable force with which the appended weight elongates the parts. But the bounds of the extenſion is limited to the elongation of the limb a little beyond its natural length; as we obſerved before from Celſus, under the preceding aphoriſm: for then the fragments may be replaced without any grating againſt each other, and without intercepting any of the ſoft parts adjacent. Nor is it eaſy to offend by making the extenſion too great, eſpecially in fractures of the larger bones; as in the femur, for example; which Hippocrates has well obſerved. But a greater or leſs extenſion will be required according as the muſcles inſerted into the fractured bones are ſtronger, by the contraction of which the limb is ſhortened. Whence Celſus ſays of theſe fractures in the thigh-bones, *Nor ought the ſurgeon to be ignorant, that if the thigh is fractured, it will be ſhorter, becauſe it can never be reſtored to its firſt ſtate: and the leg of that thigh will afterwards tread upon the ends of the toes, which muſt be attended with much weakneſs; but with more deformity, when negligence alſo heightens the misfortune* [f]. Yet it is poſſible that a too violent extenſion may injure the action of the limb by over-ſtraining the muſcles, which may cauſe a weakneſs in them, as we proved in the comment on §. 25, nº 3. But when a ſkilful ſurgeon places his fingers upon the fractured parts, while the extenſion is making, he can eaſily perceive when it is carried to a ſufficient degree, or whether it is required to be yet ſtronger.

5. The ſtrength of the hands is often inſufficient to make an extenſion of the femur, when fractured in adult and ſtrong men; whence machines have in all ages been uſed for this purpoſe. Hippocrates [g] himſelf deſcribes ſeveral machines for reducing the bones of the legs and thighs, when the hands are not ſufficient; and

[f] Neque tamen ignorari oportet, ſi femur fractum eſt, fieri brevius, quia nunquam in antiquum ſtatum revertitur; ſummiſque digitis poſtea cruris ejus inſiſti: ex quo multa debilitas eſt; fœdior tamen, ubi fortunæ negligentia quoque acceſſit. *Lib.* viii. *cap* 10. *p.* 537.

[g] De Fractur. Charter. Tom. XII. p. 209, 213.

and yet he obſerves, that it is a piece of vain oſtentation to uſe machines when the buſineſs can be done without. Several ſuch machines are figured in the works of Parey, Fabricius ab Aquapendente, and in the Memoirs of the Royal Academy of Sciences; in almoſt all which machines the parts held firm are elongated at diſcretion by turning round ſcrews. In uſing theſe it is neceſſary to make the extenſion not by ſtarts, but equably, and in ſuch a direction that they may act in a right line.

§. 350. ALL which (348, 349) being often impracticable without pain and violence, when the parts are already inflamed, ought therefore frequently to be omitted until the inflammation is abated: otherwiſe the patient may die convulſed, or invaded with a gangrene.

If the bones have been a long time fractured, a large tumour is uſually formed, which is often attended with acute pain and violent inflammation; but every extenſion of a broken limb, whether by the hands or machines, requires a pretty ſtrong force, and a rough handling of the affected parts. It would be therefore a piece of cruelty thus to harraſs the parts already much inflamed and in pain; ſince the ſeverity of the pain will endanger violent convulſions, or we may have reaſon to expect a gangrene from the rough handling of the inflamed parts. Hence Celſus prudently adviſes, after having ſaid that the fractured limb ought to be extended: *Again, if the extenſion has been neglected for the firſt two or three days, an inflammation ariſes, by reaſon of which it will be both difficult and dangerous to apply any diſtending force to the tendons and ligaments; for convulſions or a gangrene follow, or at leaſt a ſuppuration, when the whole is done as gently as poſſible: If therefore the bones are not replaced before the inflammation is formed, they ought not to be replaced till after the inflammation is gone off*[a]. And Hippocrates ſpeaking of the reduction

[a] Rurſus, ſi primis diebus id omiſſum eſt, inflammatio oritur; ſub qua et

tion of fractured bones which perforate the ſkin, likewiſe cautions that the parts be not moleſted when there is an inflammation [b]: and therefore, ſays he, the extenſion or reduction may be attempted on the ſame or on the next day after the fracture; but by no means on the third, fourth, or fifth day; for then there is more danger of convulſions from replacing the bones than from leaving them untouched. He likewiſe adds, that there are but ſmall hopes of ſucceſs, if convulſions follow the reduction of the bones; and ſays it would then be better to diſplace the bones again, if it can be done without much difficulty. And then he directs to wait till ſeven or more days are expired; after which the reduction may be attempted, if the fever and inflammation are gone off. In another place of the ſame book [c], in treating of thoſe fractures in which the bone of the femur or humerus is ſhattered, he obſerves, that there the nerves, blood-veſſels, and muſcles, are lacerated; and that if the fragments are replaced, convulſions uſually follow; whereas thoſe more frequently eſcape, in whom no reduction of thoſe bones has been attempted.

When, therefore, the violent laceration of the adjacent parts, or the too great length of time which has paſſed before proper aſſiſtance could be had, has occaſioned the parts to be invaded with great tumour, pain, and violent inflammation; we are then certain that a rough handling will endanger convulſions, or a gangrene. It is therefore neceſſary to remove thoſe ſymptoms before a reduction of the bones can be ſafely attempted; or at leaſt it is required to abate them as much as poſſible. Here, then, plentiful bleeding, the application of emollient cataplaſms and fomentations to the parts, with internal antiphlogiſtic remedies, and a plentiful uſe of diacodium, are the moſt common and effectual remedies to diminiſh the pain and inflammation, and to cauſe the tumour of the parts to ſubſide.

Theſe

et difficile et periculoſe vis nervis adhibetur: nam diſtentionem nervorum vel cancer ſequitur; vel certe, cum mitiſſime agitur, pus. Itaque, ſi anteoſſa repoſita non ſunt, poſt eam reponenda ſunt. *Lib.* viii. *cap.* 10. *p.* 532.

[b] De Fracturis. Charter. Tom. XII. p. 252, 253. [c] Ibid. p. 257.

Theſe means are to be repeated according to particular circumſtances, till their effects anſwer the intention of the phyſician; and then, but not before, a reſtitution of the fragments may be attempted. But if, notwithſtanding the uſe of theſe means, the ſymptoms remain equally violent, or are increaſed, prudence then requires to proceed no further: and if a mortification is feared, the amputation of the limb then only remains; or the fractured bones are to be let alone, and the whole buſineſs committed to nature. Hence it is that Hippocrates (as we obſerved in the comment to §. 343.) adviſes phyſicians not to meddle with theſe caſes, when they can avoid them without reflections: for if the fractured bones are not replaced, the phyſician will appear defective in his art; and if they are replaced, the patient is nearer his death than recovery.

Although fractured bones ought to be replaced as ſoon as they poſſibly can, yet a reduction of them is not to be deſpaired of even ſeveral days after the accident. Hippocrates [d], treating of a fracture in the bones of the cubitus, having firſt deſcribed the method of binding up the fractured limb, ſays, That by the ſeventh day the fractured part becomes ſo ſlender, the whole tumour diſappearing, that the fractured bones may be then very eaſily reduced to their proper places, if they have receded from thence, or were not rightly adapted in the beginning. Hence it appears, that fractured bones may be replaced and conjoined together after ſo long an interval of time.

§. 351. IF the fragments are looſe, they are to be taken out, when that can be eaſily performed. If any protuberant ſplinters or ſharp points of the bone plainly hinder the extenſion, if they are within ſight they muſt be cut off; or if they lie concealed, they muſt be firſt expoſed by inciſion. If the fracture is compound, and much complicated; and eſpecially if attended with a violent contuſion, ſplintering of the bones, or a deſtruction

[d] De Fracturis, text. 41. Charter. Tom. XII. p. 178.

ſtruction of the larger veſſels; it requires an immediate amputation of the limb, if nothing forbids.

The fragments and ſplinters of the bones create much trouble and difficulty in the cure of fractures, eſpecially when their ſharp points injure the adjacent ſoft parts. This too frequently happens, when the tibia and fibula are broken at the ſame time; and it is very evident, that even the worſt conſequences may from thence ariſe, if thoſe fragments irritate the tendons and muſcles while the limb is extending. It is therefore a juſt concluſion, That theſe fragments ought to be removed, eſpecially if they are free on all ſides from any coheſion; for then they impede the cure like any foreign body. Yet the ſurgeon ought always to examine firſt, whether the fragments may be extracted without much difficulty, or without offering any great injury or irritation to the adjacent parts: otherwiſe they ought rather to be left to themſelves, ſince they will be afterwards ſeparated and caſt out ſpontaneouſly. Celſus [a], in treating on this ſubject, ſays, That if the fragment is large and covered with membranes, it is beſt to let it looſen under thoſe membranes by the uſe of medicines. But Hippocrates obſerves, that thoſe medicines cauſe theſe fragments to ſeparate the moſt ſpeedily, which the ſooneſt cauſe a ſuppuration, and which the beſt and moſt ſpeedily procure an incarnation; for the fleſh growing up in diſordered parts, generally raiſes up the bones [b]. And in another place, treating of that caſe where there is ſome part unexpectedly caſt off from the bone, he ſays: *It is a ſign that ſome part of the bone is about to be caſt off, if the matter is copiouſly diſcharged from the wound, and runs haſtily in a manner to its orifice or opening* [c]. Parey [d] predicted in himſelf, that ſome part of the bone would be caſt off, when he obſerved the lips of the wound ſwell, diſcharge a thin and crude ichor, and the circumjacent fleſh

[a] Lib. viii. cap. 10. p. 540.

[b] De Fracturis, Charter. Tom. XII. p. 254.

[c] Signum eſt oſſis abſceſſuri, ſi pus copioſius ex ulcere profluat, et quaſi ad exitum feſtinet (και οργαν φαινεται.) *Ibid.* p. 240.

[d] Livre xv. chap. 25. p. 346.

fleſh appear ſoft like a ſponge. But what conſiderable fragments are ſometimes thus caſt off by the aſſiſtance of nature only, is evident from the inſtance alledged in the commentary on §. 343.

If any protuberant ſplinters or ſharp points, *&c.*] Sometimes it happens that the extremities of the fractured bones are ſharp-pointed, which is by Celſus [e] deſervedly pronounced to be one of the worſt ſpecies of fractures, becauſe they cannot be eaſily retained in their ſituations after they have been reduced, and becauſe they wound the adjacent parts. If then the extenſion of the limb is prohibited by theſe ſharp points of the bones, nothing remains but to cut them off if they ſtick out. Celſus, in treating on this ſubject, ſays, That if the ſharp point ſticking out from the edge of the bone is long, it ſhould be cut off; but if ſhort, it is to be raſped or filed away, and both the points and edges are to be reduced to an even ſurface by a ſcalprum: and after this the bone itſelf is to be replaced [f], *&c.* Hippocrates obſerves, that the eminences of fractured bones are to be cut off if they are offenſive, appear naked and troubleſome, or wound the fleſhy parts; and then he ſays, That as for the reſt of the fragments, it matters not much whether they are cut off or not; for you may be very well aſſured, that the boney parts which have been laid quite bare of their fleſh, and become dry, will all entirely exfoliate or be caſt off: but one ought not to cut off a part of the bone which will ſeparate or ſcale [g], *&c.* And though it may ſeem cruel, yet it will be neceſſary even to cut through the whole integuments, and remove theſe fragments, when they wound the adjacent parts, or prevent the due extenſion of the broken limb. The common people uſually believe, that ſurgeons, being hardened in their practice, are often regardleſs of the miſeries of others, and ſometimes uſe the knife and cautery where more gentle methods would ſucceed with equal ſafety, though more ſlowly. But as they themſelves are ſubject to the like calamities and diſorders,

[e] Lib. viii. cap. 7. p. 524. [f] Ibid. cap. 10. p. 539.
[g] De Fracturis. Charter. Tom. XII. p. 256.

ders, it is hardly credible that they ſhould prefer a ſeverer to a more gentle method, even upon themſelves, if there were not important reaſons to urge it. And Parey, having received a very bad fracture of the leg, adviſed the expert ſurgeon who attended him not to ſpare him as a friend, but to enlarge the wound by the knife, that the bones might be more commodiouſly replaced, and the ſplinters be extracted by his fingers, at leaſt ſuch as were found unattached to the adjacent parts [h].

If the fracture is much compounded, *&c.*] If the laceration of the parts is ſo great, as totally to deſtroy the vital circulation of the humours through them, there are then no hopes left, but the whole will be in a little time corrupted: whence there remains but one remedy in this caſe, namely, to extirpate the part thus affected; provided there is reaſon to hope that it may be performed without deſtroying the patient's life. For as the ſeparation of the corrupted parts, and the union of thoſe which have been divided, depend on the circulation of healthy juices through ſound veſſels; therefore if any of the larger veſſels are injured, or have their ſtructure deſtroyed by a violent contuſion, ſo as to aboliſh the motion of the humours through the affected parts, there can be then no hopes of ſucceſs without extirpation. But it muſt be well remarked, that this laſt and dangerous remedy ought not to be put in practice, till we are aſſured there is no life remaining in the part; for we are taught by ſurpriſing inſtances, that life has ſometimes returned into the parts when they have been adjudged to be perfectly dead: therefore it is beſt to wait at leaſt a day or two; and in the mean time to treat the parts well with ſuch antiſeptic fomentations as may preſerve them from putrefaction, ſince we are provided by art with remedies of this nature, in which we may confide, as was ſaid before under the cure of Contuſions. But to ſhew that we ought not immediately to have recourſe to extirpation in the worſt kind of fractures, it will be ſufficient to alledge the wonderful caſe which we mentioned in the

[h] Livre xv. chap. 23. p. 334.

the commentary to §. 343. A man had the tibia and fibula miſerably fractured by the wheels of a carriage loaded with ſeveral thouſand weight paſſing over his leg; which made ſuch a violent contuſion and laceration of the parts, that the whole limb might have been eaſily cut off with one cut or two of the ſciſſars. The bones were quite laid bare of all their integuments; a profuſe hæmorrhage much weakened the patient; and all the circumjacent parts, being miſerably contuſed, ſwelled greatly; ſo that there were ſcarce any apparent hopes of preſerving life in a member ſo grievouſly mangled. But after replacing the bones, a large ſuppuration followed, attended with a great tumour and a cadaverous ſmell, which gave room for apprehending the worſt conſequences; and therefore it was not without reaſon that a very ſkilful ſurgeon, who was conſulted, adviſed to amputate it. But the other ſurgeon, who had attended from the firſt of the accident, confiding in the patient's ſtrength and good habit, with the favourableneſs of the ſeaſon of the year, there being neither fever nor great pain, was bold enough to defer this ſevere and hazardous remedy, and by continually fomenting the parts with wine or its ſpirit he prevented any putrefaction. After two month's time, a large portion of the os tibiæ was ſeparated and caſt out, while the fragments of the fibula in the mean time united. The loſt part of the tibia was repaired with good callus; ſo that in the ſpace of a year the cure was compleated, and the limb perfectly recovered its uſe, without any deformity remaining [i].

§. 352. THE reſtitution of the fragments to their proper places, is performed, by turning round the part ſo gently, ſlowly, and cautiouſly, after it is duly extended (349) and prepared (351), that the parts of the bone may correſpond properly with each other; and then let the diſtorted muſcles be replaced in their proper

i Traite Complet de Chirurgie par M. de la Motte, Tom. IV. p. 284, —290.

ſeats; and all without intercepting any of the ſoft parts.

The ſurgeon who undertakes the cure, commits the extenſion of the fractured part to the other aſſiſting ſurgeons, or to ſervants; but the replacing of the fragments while the part is duly extended, is his own proper buſineſs, ſince the neatneſs of the cure depends entirely thereupon. Hence Hippocrates [a] obſerves, that the patient is to be ſo placed, that the affected part may be oppoſed to the light, that in its extenſion the operator may diſcern whether it continues nearly enough in a right line: If then the extenſion is ſo far continued, that the bones, which before rid over each other, can be reduced to their priſtine ſituations without injuring the circumjacent parts, the ſurgeon may proceed to direct and replace the fragments by the action of his hands and fingers upon the fractured parts. It muſt be here well remarked, that it is not ſufficient to bring the bones together in contact, but it is neceſſary to place the fragments in the very ſame poſition which they had before the fracture: As for example, when the os humeri is fractured, the ends of the bone may be ſo adapted that the arm will remain twiſted, and the ſituation and direction of all its muſcles altered and diſturbed; whence might follow a great deformity of the limb, with a depravity of the uſes of the affected parts. Great caution is therefore neceſſary in this caſe, and the work muſt not be done too much in a hurry; for it will be much more difficult to correct afterwards an error that has been once committed. But when a due extenſion has been made, the muſcles attached to the bones, uſually reduce the fragments to their proper places by their contraction ſo ſoon as the extenſion is remitted; or, if they ſhould be embarraſſed or twiſted, the ſkilful ſurgeon may correct and help them, by gently turning and preſſing on them with his hands.

It muſt alſo be remarked, that the extended part muſt not be let looſe all of a ſudden, and at once, but by degrees; for otherwiſe there would be danger of intercepting

[a] De Fracturis, textu 17. Charter. Tom. XII. p. 166.

cepting ſome of the adjacent parts betwixt the fragments of the bones, which would prevent their union, and excite pain, inflammation, and other bad ſymptoms, as is ſufficiently evident.

§. 353. THAT the bones are properly reduced, the ſurgeon knows from the anatomy of the parts, by comparing the affected part with that which is ſound, by the ceſſation of the pains, and by the reſtitution of the part to its natural figure and length.

After it is judged that the fragments have recovered their proper ſituations, it muſt be carefully examined, before the bandages are applied, whether the reduction of the fragments is ſuch, that the other adjacent parts alſo retain their natural ſituations; and then it is uſual for the ſurgeon to aſk the phyſician preſent to examine the whole. But that they are thus replaced is known,

From anatomy.] For it is from thence that we are acquainted with the ſituation and figure of the bones. And in ſuch parts where the uncovered bones may be eaſily felt, one will readily diſcern whether the fragments deviate from their proper ſituations; as for example, by moving the fingers down the whole length of the ſpine of the os tibiæ. But it is not ſo eaſy to diſcover this in other parts, where the bones are covered with thick muſcles.

By a compariſon of the ſound part.] This is a method of the laſt importance in order to determine certainly whether the fragments are rightly replaced. For example, if the bones of the leg are fractured; after reducing them, the diſeaſed leg is to be compared with the other which is ſound, and a careful examination muſt be made whether the ſame cavities, protuberances, *&c.* appear in each alike. For it is the bulk and poſition of the muſcles that gives the ſhape of the limb; and if theſe appear altogether the ſame in the affected and in the ſound limb, we may be certain that all the parts retain their proper ſituations. This is what Celſus ſeems to intend, when he ſays, That, after the bones

have been reduced to their proper places, (*At membrum alteri æquatum, involvendum duplicibus triplicibusve pannis*, &c.) "the limb appearing uniformly like the "other, is to be rolled up with cloths two or three times "doubled, *&c*[a]."

The ceſſation of the pain.] When the fragments ride over each other, it is impoſſible but the adjacent parts muſt be preſſed and diſtracted; and if the fragments are ſharp-pointed, they muſt neceſſarily prick and lacerate thoſe parts; whence it is ſufficiently evident from what cauſe ſuch excruciating pains frequently ariſe in fractures. But ſo ſoon as the bones are reduced, the cauſe of this pain then ceaſes; and therefore the pain itſelf immediately goes off, or at leaſt is much abated, (ſince a violent contuſion or laceration of the parts may ſometimes cauſe the pain to remain after the bones are well reduced): and then we are aſſured, that no parts are intercepted betwixt the fragments if the pain ceaſes. Hence Celſus[b] lays it down as a poſitive rule, That if the pain is removed, it is a ſign the bone is reduced.

By a reſtitution of the part to its natural length and figure.] This may be known by comparing the part injured with that which is ſound: for if the fractured bones are not joined oppoſitely but obliquely, which happens when they are diſplaced, the limb is then ſhorter than that of the other ſide, and its muſcles ſwell[c].

But great circumſpection is required in comparing the fractured with the ſound limb; ſince the moſt ſkilful have been ſometimes deceived in this reſpect. A man broke his thigh-bone near its neck, whence the fracture was at firſt miſtaken for a luxation. The fragments being replaced (as was imagined) in their natural ſituations, the ſurgeons compared the length of the affected limb with that which was ſound, and the former was found ſhorter than the other: but as it could be pulled as long as the other ſound limb without any violence, nothing amiſs was ſuſpected. Yet the patient halted after the cure, and the fractured limb was apparently ſhorter than the other. When they examined again, and extended both the legs as the patient lay

[a] Celſus, lib. viii. cap. 10. p. 532, 533. [b] Ibid. p. 532. [c] Ibid.

lay on the bed, they found that without difficulty the injured leg might be extended as long as the other; and they then found, that the os ilium of the affected ſide had deſcended in the firſt extenſion, and ſo gave the appearance of a falſe equality in the two limbs; ſince the flexibility of the loins eaſily permits the os ilium to deſcend with the extended thigh. Therefore when the ſurgeon examines whether the length of the injured leg is equal to that of the ſound one, he ought to be certain that the oſſa ilii on each ſide are placed in the ſame line of altitude [d]; for it is poſſible the patient may elevate or depreſs the os ilium of one ſide to avoid pain.

§. 354. THE retention of the bones in their ſituations is performed with bandages, compreſſes, and ſplints, by keeping the limb at reſt in a box or caſe, and by preventing or directing the action of the muſcles.

It is often much more difficult than is commonly imagined to retain the reduced fragments in their proper ſituations; and it is in this part of the cure of fractures, that the ſkill and dexterity of the ſurgeon are principally apparent. For the muſcles attached to the bones may by their contraction diſplace the fragments from their natural ſituations; and the ſame accident may alſo ariſe from coughing, ſneezing, moving the limb in ſleeping, *&c.* which laſt is a circumſtance lamented by Parey [a], *viz.* that in his ſleep the muſcles being ſtrongly contracted elevated his broken leg, whereby the fragments were immediately removed from their contacts, and made it neceſſary to replace them again by a new extenſion, not without extreme pain, followed by an inflammation, fever, and ſuppuration. It is therefore neceſſary ſo to ſecure the injured limb, as that it may continue quite immoveable. And this is effected,

By bandages.] Various bandages are applied to fractured limbs, according as the dreſſings are required to remain a longer or a ſhorter time upon the parts before they are renewed. In a ſimple fracture, a ſpiral

[d] Academ. des Sciences, l'an 1722. Mem. p. 450, 451.
[a] Livre xv. chap. 25 p. 346.

bandage with one or two heads is sufficient [b]. But when a wound, violent contusion, inflammation, *&c.* attends the fracture, it would be inconvenient to remove this apparatus every day to treat the affected parts with proper remedies: for the injured limb must be lifted up in order to take off and re-apply the spiral turns of the bandage; which can scarcely be done without danger of displacing and separating the fragments from each other. Therefore another method has been contrived by surgeons, namely, a foliated bandage, with eighteen leaves or *heads*, as they are often called; being formed of three pieces of linen laid over each other, and cut into three parts by two slits on each side; but so however that the piece of linen next the limb is the shortest, the other a little longer, and the outermost the longest of them all. This foliated bandage being moistened with oxycrate, or some such liquor, is placed under the injured part, and then the two middle leaves or heads of the innermost piece of linen are first applied over the part crossing each other; and then the rest of the leaves crossed over each other successively in the same manner. So that it is necessary for the pieces of linen to be long enough to exceed a little the thickness of the limb, to wrap over. But a better idea of this bandage may be had from figures than from any description alone; for which consult Heister [c], and others who have treated on bandages. But tho' this bandage is reckoned a modern invention, there seems to be one of the like make described in Hippocrates [d]. For in cases where he expected any large fragment to separate or be cast out, he orders to take double cloths of the breadth of half a span, not less; a little shorter in length than to go twice round the limb, but considerably longer than to go once round: which cloths are to be as many in number as the case may require. Having dipped these in black austere wine, he would have them applied to the middle of the affected part, in the manner usual for applying bandages with two heads; then the heads to be crossed over

[b] Heister. Institut. Chirurg. tab. ii. lit. b, c.
[c] Ibid. tab. ix. fig. 4. & tab. xxxviii. fig. 25. & p. 1244.
[d] De Fracturis. Charter. Tom. XII. p. 241, *&c.*

over each other, the right towards the left and the left towards the right; nor does he order them to be in the leaſt tightened, but to be diſpoſed ſo as that the wound may appear. Galen, in his explanation of this text of Hippocrates, gives almoſt the ſame deſcription of this foliated bandage. And yet Celſus, in the cure of a fracture accompanied with a wound of the ſoft parts, makes no mention of any ſuch bandage: but he only directs to make the deligation of the part more looſely than if it was not wounded; and rather to increaſe the number of bandages, that they may ſecure it equally though looſely [e]. The great uſefulneſs of this bandage conſiſts in admitting the dreſſings to be renewed, in order to cure the wound, without taking off the bandage.

But the neceſſary qualities of bandages in general are well repreſented by Hippocrates, who ſays, That they ought to be light, thin, ſoft, clean, broad, without any ſeams or eminencies, and of a ſufficient ſtrength to bear a little ſtronger force than that applied to extend them; nor are they to be uſed dry, but moiſtened with ſome liquor, in which it is uſual to dip them [f].

It is ſufficiently evident, that the foliated bandage before deſcribed does not ſo firmly retain the parts as that which is made by ſpiral circumvolutions: but as the wound, ulcer, or violent contuſion, which accompanies the fracture, would not ſupport ſo violent a compreſſure, therefore the foliated bandage is in this caſe ſufficient. The ſpiral bandages have principally this advantage, that they retain the replaced fragments in their ſituations by an equable preſſure; and therefore it is that ſurgeons uſually bind up the fractured part with a ſpiral bandage at firſt; and if, for example, they carried this firſt bandage from the left to the right, they then began with another ſpiral bandage upon the part, and carried it from the right to the left, in order to make the more equable preſſure, and to act principally upon the fractured part. All which is again beautifully deſcribed by Hippocrates; who ſays, treating on the

[e] A. Corn. Celſi Medic. lib. viii. cap. 10. p. 539.
[f] De Medici Officina. Charter. Tom. XII. p. 62.

the cure of fractures of the bones of the cubitus, *After this, you muſt make your deligation with a bandage, fixing the end of it upon the fracture, ſo that it may hold faſt, but not violently compreſs, the parts. After two or three turns thus made with your bandage upon the fracture, carry it upwards, to prevent the too great afflux of blood, and there let it terminate. As for thoſe bandages which are to be the firſt applied, they ought to be not ſo long: but the beginning of your ſecond bandage is to be faſtened upon the fracture, and paſſed once round it; and then let it be carried downwards, tightening it gently, and making your circumvolutions at larger intervals*, &c[g]. In the ſame place he has alſo ſeveral other uſeful admonitions concerning the uſe of bandages; as there are alſo in Celſus[h].

Compreſſes.] It is an admonition of Hippocrates[i], That it ought to be well obſerved, that upon ſuch parts as are acuminated, or have any declivity, all bandages looſen or fly off, as in the head upwards, and in the leg downwards. And therefore in another place he ſays[k], That ſuch parts as taper towards their extremities, are to be made even with compreſſes rolled up, *&c.* Compreſſes have therefore this principal uſe, that, when properly applied, they give the affected parts a cylindrical figure, that the bandages may hold the faſter, and not ſlip off of their own accord towards a ſmaller end of the limb. Alſo when, for example, the end of the broken os femoris recedes outwards; in that caſe, the preſſure of the bandage may be ſo determined by the application of compreſſes, as to act moſt upon the receding part, and by that means prevent the fragments of the bone from being eaſily diſplaced again that way by the action of the muſcles or by

g Poſtea oportet faſcia deligare, principio ſupra fracturam injecto, ſic ut firmet quidem, non tamen vehementer comprimat. Ubi bis vel ter ſic faſciam ſuperduxerit, ad ſuperiora diſtribuat, quo ſanguinis affluxus intercipiatur, ibique deſinat. At primas faſcias minime longas eſſe oportet; ſecundarum vero initium ſupra fracturam injiciendum eſt, ut ſemel circa illam revolvatur, tum deorſum demittatur, lenius adſtringatur, atque ex majori intervallo circumdetur. *De Fracturis. Charter. Tom. XII. p.* 169,——173.

h Lib. viii. cap. 10. p. 533. i De Medici Officina. Charter. Tom. XII. p. 48. k De Fracturis, textu, 34. Charter. Tom. XII. p. 173.

by any other cauſe. But of what conſiderable uſe compreſſes are in directing and preventing the action of the muſcles, we ſhall preſently declare.

Splints.] Tho' the injured part may be well ſecured by compreſs and bandage duly applied, yet theſe will not prevent the limb from bending in the part fractured, if it ſhould be moved in ſleep, or by ſome accident; whence the ſituation of the replaced fragments would be diſturbed. Therefore ſurgeons fix ſplints, of thin wood or thick paſteboard, round the limb, to prevent this accident. Theſe ſplints are required to be firm enough to hinder the bending of the limb in the fractured part; being ſuch as may be eaſily adapted to the figure of the injured part, and are at the ſame time ſo light that they prove no incumbrance by their weight. But becauſe the hollow ſtalks of the plant ferula, being very light, and yet ſtrong, induced the ancients to uſe them for this purpoſe, it is from thence that this part of the apparatus for the cure of fractures has acquired the name of *ferulæ* or *ſplints*.

Hippocrates, treating of them, ſays, That they ought to be light, and of the ſame ſize, with obtuſe or rounding ends; being a little thinner in thoſe parts where they are to be tied on, and thickeſt where they cover the fracture [l]. The ſplints are faſtened on by ſlight ligatures only, becauſe they are not applied to preſs, but only to defend, the bandage, as Hippocrates prudently obſerves in another place [m]; where he alſo adds, That care muſt be taken not to hurt the prominent parts, which are not defended with fleſh, by the application of the ſplints; for from thence might follow an ulcer, and the tendons might be laid bare. Hence he orders, in a fracture of the cubitus, not to place the ſplints by the ſide of the thumb or little finger; or, if it is neceſſary to apply them ſo, to let them be very ſhort; for otherwiſe the prominent ends of the radius and ulna near the wriſt would be injured. The ſame is true likewiſe in a fracture of the leg: in which care

[l] De Medici Officina, p. 79. Charter. Tom. XII.

[m] De Fracturis, textu 14. Charter. Tom. XII. p. 179. & de Medic. Officina, ibid. p. 80.

care muſt be taken not to let the ſplints touch the ankles, nor the protuberant parts of the tibia and fibula at the knee; for the whole preſſure of the ligatures retaining the ſplints in their places, would be returned upon thoſe parts only. I have ſeen an error of bad conſequence, when the ſurgeon has neglected this caution; for a gangrene was produced at the ankles and knee, barely by the preſſure of the ſplints upon thoſe parts. But it is evident from what has been ſaid before, that if only one bone is broken in thoſe parts which have two, that then ſplints are not always ſo very neceſſary to be uſed. This is well obſerved by Celſus, who ſays almoſt the ſame with Hippocrates concerning ſplints: *Every thing muſt be conducted with greater care and exactneſs for retaining the bones, when one affords no ſupport to the other: But when one of them remains whole, it will of itſelf be of more ſervice than bandages and ſplints* [n]. From the places before cited from Hippocrates and Celſus, it appears that they did not apply the ſplints before the ſeventh day: but the modern ſurgeons apply them at the firſt dreſſing, which Parey [o] took care to have put in practice upon himſelf.

Box or caſe.] It is alſo further required to retain the injured limb ſo ſecurely, that it may remain immoveable, and as eaſy as poſſible; and as it is neceſſary for the limb to continue thus always in the ſame poſture, therefore the injured parts are to be ſo diſpoſed, that they may continue a long time at reſt with the leaſt uneaſineſs. Thus, for example, in a fracture of the leg or thigh, the articulation of the knee ought to be a little inflected; for no body can lie a long time with their leg extended. In the next place, the limb is to be ſupported by pillows, that its weight may be ſuſtained by the whole length and lower ſurface of the limb, and not by one or two parts only; for that might occaſion an inflammation and a gangrene of the parts too much

[n] Curioſius omnia in continendis oſſibus fiant, ſi neutrum alteri auxilio eſt. Nam, ubi alterum integrum eſt, plus opis in eo, quam in faſciis ferulisque eſt. *Lib.* viii. *cap.* 10. *p.* 536.

[o] Livre xv. chap. 23. p. 344.

much preſſed. Thus a gangrene of the worſt kind has been ſometimes obſerved to invade the heel from this cauſe only. And Hippocrates [p] obſerves, that by a too long lying of the limb upon the heel, the os calcis itſelf becomes at length corrupted, and is a caſe that may be attended with the greateſt danger; becauſe, when this bone is corrupted, the diſorder may continue as long as the patient lives. To avoid this accident, Hippocrates [q] adviſes, in another place, to fix the broken leg, after it is bound up, upon a ſoft plane, ſo that it may neither incline to one ſide nor the other, nor riſe higher before than behind, nor be apt to turn eaſily any way. For if the limb is not ſuſtained by its whole length, but preſſes only upon the heel and knee, an incurvation may follow in the fractured part, from the weight of the other parts. The ſame incurvation may alſo follow, if the fractured part is ſuſtained, but the foot and heel are permitted to deſcend lower than the reſt of the leg. But as for the caſes uſed to retain broken legs from moving any way, Hippocrates [r] confeſſes that he knows not what to ſay of them. They may indeed be of ſome uſe, but not ſo ſerviceable as is commonly imagined: for if the body is turned to either ſide, the caſe will not hinder the leg from following, if the patient himſelf is not cautious to prevent it; nor will it prevent the leg from being moved even without any motion of the body. But he adds, that the operator will be leſs liable to blame from the vulgar, if he uſes one of theſe caſes. But the modern ſurgeons have contrived very beautiful machines for the commodious placing and retaining a fractured limb from being moved, and which at the ſame time eaſily permit the dreſſings to be renewed in complicated fractures. Such a caſe for the retention of a broken leg, is deſcribed in the Mem. Acad. Reg. Scien. [s], and the figure and deſcription of it may be alſo ſeen in Heiſter's Surgery [t]. A commodious diſpoſition of the affected limb, and of the reſt of the body, is evidently of the greateſt importance

[p] De Fracturis. Charter. Tom. XII. p. 200, 201. [q] Ibid. p. 217.
[r] Ibid. [s] L'an 1718, Mem. p. 396. [t] Tab. ix. lib. xi. cap. 10. ſect. 2.

portance towards a cure in fractures, where the patient is obliged to lie ſo long a time; and therefore the moſt ſkilful ſurgeons themſelves ſtoop to lay the patient's bed as it ought to be [u], that they may be aſſured all is right.

By preventing and directing the action of the muſcles.] In this the ſkill of the ſurgeon is principally apparent: for when the bones are fractured, the direction of the muſcles attached to them is diſturbed, if not prevented by art; and by contracting, they will diſplace the fragments. Thus for example, if the radius is fractured, the pronator quadratus and the ligament betwixt the radius and ulna will draw the fragments of the former towards the latter; and this evil will be ſtill augmented by the preſſure of any bandage. But if compreſſes are placed betwixt the radius and the ulna, this will occaſion the preſſure of the bandage to be returned chiefly upon the compreſſes, and theſe will prevent the radius from approaching towards the ulna. The ſame may alſo take place in a fracture of the fibula. But when the bone is fractured into ſeveral pieces, there is danger leſt the contraction of the muſcles ſhould thruſt out the fragments, by which means the limb might afterwards become ſhorter: and therefore, in ſuch a caſe, it will be neceſſary to preſerve the due length of the part by the application of machines that prevent contraction, till the uniting of the fragments and ſtrength of the muſcles prove ſufficient for the reſiſtance. But of this we treated in the commentary on §. 346. That there is often no ſmall difficulty in the deligation of theſe fractures has been well obſerved by Hippocrates [w], who, in treating of a fracture of the heel, ſays, that it is not every one who is able to make a proper deligation in thoſe caſes; for if the common bandage of the ankle is applied, by paſſing the roller about the foot and tendo achillis, the preſſure of the bandage would again diſplace the calcaneum. And then he proceeds to deſcribe the beſt method of deligation in the ſame caſe. From all this it is evident how extremely neceſſary it is to have a knowledge from anatomy

[u] Traite Complet de Chirurgie, par M. de la Motte, Tom. IV. p. 179.
[w] De Fracturis. Charter. Tom. XII. p. 199.

anatomy of the adjacent tendons and muſcles, in the cure of fractures.

§. 355. TOO tight bandages intercept the circulation, ſo as to produce a tumour and a gangrene; from whence follow infinite diſorders: they ought therefore to be gently tightened, ſo as to hold firm, and but moderately preſs upon the ſmall veſſels.

Great evils often ariſe from too ſtrict bandages made with a deſign to retain the replaced bones. For it commonly happens that the fractured limb begins to ſwell within a few hours time, and eſpecially about the part of the fracture; whether the tumour be a conſequence of the fracture, contuſion, or the rough treatment of the part in order to replace the bones and make a due extenſion: ſo that if the bandage was too tight at firſt, before this tumour appeared, it is evident that as the tumour ariſes the preſſure of the bandage will increaſe; whence follow an obſtruction of the compreſſed veſſels, an inflammation, or even a total ſtoppage of the circulation, and a gangrene. Intenſe pains often ariſe from the too great ſtricture of bandages; and if the ſurgeon neglects the patient's complaint, he often finds his error in a gangrene of the part, which, being corrupted, can be only remedied by extirpation. Hence all ſkilful ſurgeons carefully admoniſh to inquire into the cauſe of the patient's pain when he complains; and rather to remove all the dreſſings, than to ſuffer a deſtruction of the affected part, or even hazard the patient's life. The bad events of ſuch a neglect have been frequently obſerved, and ſeveral inſtances are related by the celebrated Le Motte [a]. It will be, therefore, the leaſt hurtful of the two to make the bandage over ſlack than too tight, becauſe the former may be corrected by the application of a ſecond bandage. But the ſigns by which one may know whether there is a ſufficient ſtricture made by the bandages, are very well enumerated by Hippocrates, where he ſays, *But the ſigns which denote*

[a] Traite Complet de Chirurgie, Tom. IV. p. 272, &c.

denote that the fracture hath been rightly treated, and the deligation duly made, are, if upon inquiry the patient affirms that he feels a ſtricture, though but a gentle one, and eſpecially about the part fractured. And it is a ſign the bandage is not too tight, if, within the firſt day and night after the dreſſing, the patient feels the ſtricture not diminiſhed, but rather increaſed; and the day after a ſlight and ſoft or œdematous ſwelling appears in the hand or lower part. The ſecond day being elapſed, the patient feels the ſtricture of the bandage diminiſhed; and on the third day it ſeems to be quite looſe. But you may obſerve, if any of the forementioned appearances are abſent, that then the deligation is looſer than it ought to be; or if they exceed beyond this deſcription, then the bandage has been applied too tight [b]. If that tumour which invades the inferior part of the limb below the bandage appears ſmall, ſoft, and white, it denotes that the veins are but ſlightly compreſſed; from whence, with the inactivity of the part not forwarding the blood through the veins, it is that the tumour itſelf ariſes; but when the parts are ſwelled above the bandage, it is a ſign that the arteries are likewiſe compreſſed, which may produce an inflammation or a gangrene. But when, on the third day, the bandage appears ſpontaneouſly relaxed, by the diminution of the ſwelling in the parts, Hippocrates [c] then orders the bandages to be drawn a little tighter; and to repeat the ſtricture likewiſe on the ſeventh day, if it ſhall be found neceſſary; always obſerving the cautions before given. But when the dreſſings are removed, it ought always to be carefully examined whether any of the fragments have receded from their natural ſituations, as we ſaid before at §. 353.

§. 356.

b Signa autem recte curati hæc ſunt, et terminus deligandi. Si rogaveris, an prematur, et dixerit, ſe premi quidem ſed leviter, et maxime circa fracturam. Moderationis autem indicia ſunt, ſi illa die, qua deligatus fuit, ac nocte, ipſe ſibi videatur non levius, ſed valentius adſtringi; poſtridie autem parvus tumor (οἰδημάτιον) in manu oriatur et mollis. Signum enim hoc tibi erit moderatæ adſtrictionis. Labente jam die, minus adſtrictas faſcias ſentiat, ſed tertio die laxas omnino. Scire autem licet, ſi quid ex dictis abſit, quod juſto laxior ſit deligatio; ſi quid ex dictis ſuperet, plus juſto fuiſſe adſtrictam *De Fracturis textu* 37. *Charter. Tom. XII. p.* 175, *&c. et de Medici Officina, ibid. p.* 95.

c De Fracturis, textu 40. Charter. Tom. XII. p. 177, &c.

§. 356. WHEN fractures are accompanied with wounds, they are to be treated according to the rules of art, as mentioned from §. 185 to 239, but they ſeldom admit of deligation. The ſame is alſo to be underſtood of an inflammation, pain, tumour, and other ſymptoms attending.

If ſo conſiderable a wound attends a complicated fracture, that it cannot be ſafely left to nature; then the foliated bandage, with eighteen heads or leaves, ought to be uſed, that the wound may be commodiouſly treated without danger of ſeparating the fragments. It is true, this bandage does not ſo firmly retain the part as that made by ſpiral circumvolutions; but in this caſe the wound will not permit a greater ſtricture. It is an ill practice of ſome to compreſs the circumjacent parts by a ſpiral bandage, leaving the place of the wound open; or elſe, by cutting out a piece of the bandage, to leave an opening over the wound: for when the circumjacent parts are compreſſed, and the wound left open, the humours are derived more forcibly and copiouſly to the wounded part; whence follow inflammation, tumour, proud fleſh, and the like. Even Hippocrates has condemned this method, when he ſays, *It muſt neceſſarily cauſe the wound to riſe up into a tumour; for even if ſound fleſh is compreſſed or bound on all ſides, and left free in the middle, it will there ſwell greatly, and alter its colour; how then is it poſſible for the wound to eſcape theſe? The wound muſt therefore of neceſſity be diſcoloured, and the juices will be there forced out; whence it will not ſuppurate, but weep or diſtil a ſharp water, and bones will be ſeparated or caſt out which ought to have been retained*[a]. And he afterwards adds, that he ſpeaks of this the more largely, that every body might reject this ill method of deligation, which was uſed by many. What elſe has been ſaid concerning the cure of wounds,

[a] Neceſſe eſt, ulcus in tumorem aſſurgere: nam ſi ſana caro hinc atque hinc vinciatur, in medio vero non, maxime ibi tumebit, et colorem mutabit, quomodo ergo ulcus hæc effugiet? neceſſe ergo eſt, ulcus decolorari, et materiam huc exprimi, unde lacrymabitur et non ſuppurabit, oſſa vero, et quæ abſceſſura non eſſent, abſcedent. *Ibid. p.* 234, &c.

ought here alſo to be obſerved; and if part of the bone is laid bare by the wound, it will be convenient to uſe thoſe methods which were propoſed under Wounds of the Head expoſing the Cranium. But a ſeldom removing of the dreſſings, convenient in moſt other wounds, as we before obſerved, will be more eſpecially uſeful in theſe; becauſe great care muſt be always taken not to diſturb the ſituation of the replaced fragments.

Now although an exact regimen may not ſeem to be ſo very neceſſary for a ſimple fracture in a healthy perſon, yet it muſt be obſerved, that no worſe accident can happen here than an inflammation ſupervening the fracture; for then the bandages muſt be taken off, and ſuch things applied as are proper to remove the inflammation, which had been better prevented. Phlebotomy therefore, with a thin diet, will be extremely convenient; more eſpecially in thoſe of a full habit, inclined to inflammations. Every thing, too, muſt be avoided which augments the quantity or motion of the circulating humours. And theſe cautions are more eſpecially neceſſary to be obſerved for the firſt days, when there is the moſt danger of an inflammation. Hence Hippocrates pronouces: *But the diet for thoſe who from the beginning have no wound nor diſtortion of the bones, need not be ſo low and exact; but let them eat ſparingly until the tenth day, eſpecially when they have no exerciſe. And let them uſe ſoft ſhell-fiſh, which gently excite to ſtool; but let them abſtain from wine and fleſh: afterwards they may by degrees indulge themſelves*[b]. But when a fracture is accompanied with great tumour, or violent inflammation, thoſe remedies which we recommended in the cure of contuſions §. 334. muſt be ſpeedily uſed, and boldly repeated, according to the urgency of the ſymptoms; and at the ſame time a very thin diet will be proper.

§. 357. THEN follows a concretion or union of

[b] Diæta autem illis, quibus ab initio nec vulnus adeſt, nec oſſa eminent, ſufficit non adeo tenuis et exquiſita (υποφαυλη); minus tamen cibi ſumant, uſque ad decimum diem, præſertim cum quieſcant. Adhibeantque ex obſoniis mollibus, quæ modice alvum ſollicitent, ſed a vino et carne abſtineat: poſtea paulatim ſe reficiant. *Ibid. textu* 45. *Charter. Tom. XII. p.* 181, &c.

of the parts by a callus, within the ſpace of betwixt 20 and 70 days, ſooner or later, according to the age of the patient, the thickneſs of the bone, the incumbent weight it is to ſuſtain, and the ſeaſon of the year.

The third thing required to be done in the cure of fractures in general (§. 347, n° 3.) is to procure an union or concretion of the replaced and retained fragments with each other; and, if there is any loſs of ſubſtance in the bone, to procure a regeneration of it. But it has been cuſtomary with phyſicians and ſurgeons to give the name of *callus* to that ſubſtance by the interpoſition of which the fragments are united to each other. But what a callus is, and how it is generated, has been explained in the commentaries on §. 343, and 347, n° 3. For it there appears, that the divided parts are united, and the loſt ſubſtance repaired, by the ingeſted aliments converted into healthy animal-fluids, derived to the parts through ſound veſſels, with a proper impetus, and in due quantities. Art does nothing more in this caſe, than replace and retain the fragments in their proper ſituations; for all the reſt is performed by the fabric of the healthy body. Therefore it need only be inquired, whether any thing is defective with reſpect to health; and, when that defect is known, to correct it by art: and in the commentary on §. 346. we treated of the chief cauſes which have been obſerved to retard the cure, or render it impracticable.

But the time in which the fragments uſually conjoin, varies upon many accounts even in healthy people. And therefore Hippocrates having ſpoken of a fracture of the cubitus conjoining within thirty days at moſt, adds afterwards, That there is nothing of this conſtant; for that the natures or conſtitutions, as well as the ages, of patients, are very different [a].

But the chief difference of the time required for the cure of fractures depends on the

Age.] For in young ſubjects the conſolidation of the fracture is the ſooneſt made; but then in theſe

[a] Ibid. textu 41, 42. Charter. Tom. XII. p. 179, 180.

there often ariſes too great a luxuriancy of the callus. In old age, the time required is much longer; for, at that time, the body rather decreaſes: whence it is found extremely difficult to procure a regeneration of the loſt ſubſtance, or a reunion of the divided parts, in ſuch people. But a middle age is of all the beſt; for then indeed the fracture conjoins more ſlowly than in youth, but it unites more firmly, nor is there ſo much danger of a luxuriancy in the callus. It was ſaid in the commentary on §. 346. that a fracture of the humerus in new-born infants has been cured within twelve days time; whereas in adults the like cure requires thrice as long a time; and in old people the time required is ſtill much longer.

The thickneſs of the bone.] The bones vary in thickneſs, according to the weight they are to ſuſtain, or the ſtrength of the muſcles which they are to ſupport and direct; whence again it has been obſerved, that (*cæteris paribus*) ſo much a greater length of time is required for the conſolidation of a fracture, as the bones are of a greater thickneſs. Thus Hippocrates ſays [b], That the os femoris takes fifty days to conjoin it; the bones of the leg and humerus, forty days [c]; thoſe of the cubitus, but thirty days at moſt [d]; fractured ribs require twenty days [e], and the bones of the fingers as many days [f], *&c.* Whence the cure of fractures of the bones are uſually compleated within the ſpace of twenty to ſeventy days time; ſince within that term the os femoris, which is the largeſt bone in the whole body, is uſually conſolidated, in a healthy man of a middle age, when no ill accident oppoſes. But when large fragments are ſeparated and removed, there is then a large portion of the ſubſtance of the bone to be regenerated, which will require a much longer ſpace of time: as is evident from the inſtance alledged in the commentary on §. 343, where a fragment of the tibia was ſeparated to the length of four fingers breadth; for there the ſpace of ten months was required, before the

[b] De Fracturis. Charter. Tom. XII. p. 223. [c] Ibid. p. 220, & p. 191. [d] Ibid. p. 179. [e] De Articulis, ibid. p. 394 [f] De Fracturis, ibid. p. 194,—197.

the patient could ſafely ſtand upon the fractured leg.

The incumbent weight.] For the callus formed in the fractured part remains a long time ſofter than the other ſubſtance of the bone. If therefore the fractured bone is one that is uſed to ſuſtain the whole weight of the body when a perſon walks, it is evident that a longer time will be required before this can be ſafely attempted. Hence a leſs time is required for the cure of the os humeri than for the bones of the leg, and more eſpecially when both bones are broken. Hippocrates [g] ſays, that a fracture of the os calcis takes ſixty days for the cure, whereas fifty days are ſufficient for a fracture of the femur: but he had before obſerved, that the os calcis is placed directly under the tibia; whence it is evident, that this bone ſuſtains the whole weight of the body. In treating of a fracture of the bones of the hand and foot, he obſerves [h], that all of them are perfectly curable within twenty days, excepting thoſe bones of the foot which are connected to, or placed directly under, the bones of the leg: for then thirty days are required to a complete cure, if the patient is willing to lie ſo long, as many will not, becauſe they think the diſorder trifling, and therefore it is that moſt of them are not perfectly well cured. For the feet ſuſtain the whole weight of the body.

Therefore, before the patient is ſuffered to have the uſe of his limb, the prudent ſurgeon ought to examine whether the callus is ſufficiently firm in the fractured part: To do which, the limb is to be taken hold of, on each ſide the fracture, by two aſſiſtants; who are then to make a gentle attempt to bend it in the part of the fracture, while the ſurgeon in the mean time applies his fingers over the callus. If now any looſeneſs or the leaſt bending of the bones can be perceived, it is a ſign the callus is not yet ſufficiently indurated: whence might follow a new fracture, or a deformity and incurvation of the limb; or at leaſt the callus, being as yet ſoft, might be expreſſed from betwixt the bones by the weight of the body, ſo as to form a protuberance, which would at the ſame time diminiſh the due length of

[g] Ibid. p. 206. [h] Ibid. p. 195.

of the limb. But in the mean time, as the diſeaſed limb is obliged to be kept at reſt for ſo long a ſpace, care muſt be taken not to let the adjacent articulation become rigid; becauſe an anchyloſis or ſtiff joint has been frequently obſerved to ariſe merely from a want of moving it: and therefore, during the time of the cure, the ſurgeon ought prudently to move the articulation at proper intervals; not ſuffering the patient to move it, leſt by an imprudent agitation the fragments might be again diſplaced after they have been properly reduced.

Though the fragments have been ever ſo well replaced, yet it is beſt to make a careful examination of the parts every time that the dreſſings are renewed; and to make a compariſon with the ſound limb, in order to obſerve whether they are both of the ſame length and figure: for if any defect as yet remains, it may be corrected while the callus is flexible; whereas when it has acquired a boney hardneſs, it will very difficultly, if at all, admit of an alteration. Whence Hippocrates juſtly obſerves, That if there is any room to ſuſpect that the bones are not properly cloſed after the ſplints are tied on; or if any thing is troubleſome to the patient, when half the time neceſſary for the cure is expired, or a little before, it will be proper to remove the dreſſings, and apply them again [i]. But we need not perhaps entirely deſpair of correcting a deformity, if any remains, even after the whole time uſual for the cure of fractures is elapſed; for obſervations confirm the poſſibility of this practice, which may ſucceed more eſpecially in younger ſubjects. A youth of ſixteen years old had a fracture of the femur, which through negligence was found, nine weeks afterwards, to be half a foot ſhorter than the other thigh; which would have occaſioned the patient to go lame all his lifetime: but a very ſkilful ſurgeon, examining the place of the fracture, found that the ends of the fractured bone were drawn up and conjoined by the ſides of each other. The patient being very robuſt, and the callus yet recent, induced him to cauſe the limb to be violently extended by aſſiſtants with

[i] Ibid. p. 181.

with ſlings; and by preſſing with his hands on each ſide at the ſame time, he reduced the fragments to their proper ſituations without any pain to the patient: thus the limb was reſtored to its due length ſo happily, that within the ſpace of a month afterwards the young man could walk without any manner of halting [k]. It has been even obſerved, that the fragments ſooner conſolidate in ſuch a caſe, than they unite with each other after being lately broken: which is alſo confirmed by another remarkable caſe from the ſame author [l]. A man having fractured both legs, was well cured: but unluckily he broke one of his legs in the ſame place again, ſix or ſeven weeks afterwards; and within twelve days time from the reduction of the fragments, the parts were ſo firmly conjoined, that he could conveniently move and elevate the leg. This ſecond accident made the patient more cautious to avoid the like again: but three months after he was thrown from a horſe, and broke his leg again in the ſame place; but yet the cure happily ſucceeded, in a ſhort time too, and almoſt without any deformity.

But when the ends of the fractured bones do not unite together, but in a manner cicatrize and remain ſeparated, then the caſe is much more difficult. That this accident does ſometimes happen, is evident from what has been ſaid in the commentary on §. 346.: And if it proceeds from a defect in the growth or nutrition of the bone, by reaſon of ſome diſeaſe, there is then no remedy for it. But if the conſolidation of the bone only ceaſes for a time, as we mentioned to have been ſometimes obſerved in women with child, the cure muſt then be deferred till they are delivered. But whether or not the method which Celſus propoſes, may be of ſervice in the like caſes, ſeems a matter of doubt. For he ſays, *But if the bones do not firmly conſolidate, either becauſe they have been frequently ſeparated or agitated, even then the cure is not difficult; for they may unite. If the caſe is of long ſtanding, the limb is to be extended, to make ſome hurt: the bones are to be divided by*

k De la Motte Traite Complet de Chirurgie, p. 194, &c.
l Ibid. p. 242, &c.

by the hand, and made rough by rubbing them againſt each other, that if any fat interpoſes it may be rubbed off, and the whole be rendered as if it was a new fracture. But great care is to be taken not to injure any of the nerves or muſcles [m]. His whole deſign ſeems to conſiſt in making a freſh wound of the bones, by rubbing them againſt each other; but if any ſplinters are thus broke off, they may occaſion much miſchief. It may perhaps be better to commit ſuch a caſe to nature only, who is often obſerved to operate wonderfully for the patient's benefit. A man had a tranſverſe fracture of both bones of the cubitus, at the diſtance of four fingers breadth from the carpus: he would neither ſuffer the bones to be replaced, nor any bandage to be applied, for fear of the pain; nor yet would he ſuffer the limb to be at reſt, which prevented the conſolidation of the fragments, and formed (in a manner) a new joint in the fractured part, with which he afterwards ſurvived without any conſiderable pain or inconvenience. After his death, one of the ſurgeons who had ſeen the fracture, diſſected the arm, and found that the ends of the upper fragments had acquired a round figure, which correſponded to cavities of the like ſhape in the ends of the lower fragments. The perioſteum was grown thicker round the divided parts of the bone, and formed as it were a ligament to confine and ſtrengthen the new articulation. Even the cavities formed in the lower fragments were much depreſſed before, and much more elevated behind; ſo as eaſily to permit a flexure of the joint forwards, and prevent too great an extenſion of it backwards, almoſt in the ſame manner as in the joint of the elbow. Theſe bones, we are told [n], were preſerved by the celebrated du Verney, among his anatomical rarities.

Sometimes the growing callus is obſerved to riſe above

[m] Si quando vero oſſa non conſerbuerunt, quia ſæpe ſoluta, ſæpe mota ſunt, in aperto deinde curatio eſt. Poſſunt enim ccire. Si vetuſtas occupavit, membrum extendendum eſt, ut aliquid lædatur: oſſa inter ſe manu dividenda, ut concurrendo exaſperentur, et, ſi quid pingue eſt eradatur, totumque id quaſi recens fiat. Magna tamen cura habita, ne nervi muſculive lædantur. *Lib.* viii. *cap.* 10. *p.* 541.

[n] Nouvelles de la Republique des Lettres, l'an 1658. p. 118, &c. et in Actis Erudit. menſe Nov. 1685. p. 513, &c.

bove the equal ſurfaces of the bones; eſpecially in ounger patients, who have their ſolids moſt ſoft and ax, and their juices more redundant: and this hap- ens much in the ſame manner as proud fleſh is form- d by a luxuriancy of the veſſels leſs preſſed in wounds f the ſoft parts. This more eſpecially happens when he repullulating and as yet ſoft veſſels are too much liſtended by the juices too impetuouſly moved in a fe- ver; for the juices are ſometimes ſent to the parts ſo abundantly, that [o] Galen ſays he has often ſeen the bloody juice poured out under the entire ſkin that in- veſts the fracture, ſo as to fill out the bandages. In ſuch a caſe, it will be convenient to uſe ſuch remedies as diminiſh the quantity of the juices, and abate their force, or drive them from the injured part. There- fore bleeding, and ſuch purges as act without infla- ming, will be here ſerviceable; joined with a ſpare diet, ſufficient to ſupport life without augmenting the quantity of the juices. A gentle friction of the parts will likewiſe be of ſervice, to carry off the too great redundancy of the juices there accumulated; to which add a more ſtrict compreſſure, that the too lax veſſels may be better ſecured to reſiſt the impulſe of the di- ſtending humours. All which are very well obſerved by Celſus: For if the callus grows out too much, ſo as to form a tumour in the place, he ſays that limb is to be gently rubbed for a conſiderable time, with a mixture of oil, ſalt, and nitre, and to be well fomented with hot ſalt-water; after which a diſcutient cataplaſm is to be applied, and the bandages drawn tighter: lax- ative pot-herbs, and alſo a vomit, are to be uſed, which both diminiſh the fleſh and callus: it will be alſo of ſome uſe to apply a fig and muſtard to the oppoſite limb, and let it remain till it has bliſtered a little, and by that it may cauſe a revulſion of the matter. When the ſwelling is extenuated by theſe means, the patient may then return to his ordinary courſe of life [p]. But if the ſuperincumbent weight of the body ſhall have forced out the callus from betwixt the bones in the form

[o] Commentario 3. in Hippocrat. de Articulis. Charter. Tom. XII. p. 394. [p] Celſus, lib. viii. cap. 10. in fine. p. 542.

form of a ring, by an imprudent uſe of the limb too early; in that caſe the limb ought to be extended again to its due length, and the exorbitant callus forced within its due bounds by an external preſſure.

But when a deficiency of the callus is feared, either from too great a compreſſure of the part, or from any other cauſe; then a looſer application of the bandages, with emollient fomentations, and a more full diet, joined with ſuch medicines as excite the languid motion of the juices, will be found more particularly uſeful. For this purpoſe, namely, to procure a more ſucceſsful reproduction of the callus, Hippocrates [q] directs, that if the limb is unbound after the ſplints have been uſed, it ought to be fomented, and afterwards bound up more gently, and with fewer bandages than at firſt. And Galen [r], in his commentaries on this place obſerves, that Hippocrates on the firſt day increaſed his number of bandages, and applied them more ſtrictly, till he came to the ſplints: but after the ſeventh day, laying aſide the ſplints and the reſt of the apparatus, he ſuffered the part to remain at reſt until the twentieth day, for the nutrition of the callus: and then he derived the matter of the callus to the part by pouring on warm water, whereas in the beginning he increaſed the number and ſtricture of his bandages to prevent the afflux of the ſame matter thither. This is well expreſſed by Ægineta, when he ſays, That ſome fractures remain without a callus, beyond the time allotted by nature for its formation; either becauſe of the frequent undreſſings, an immoderate uſe of fomentations, unſeaſonable motion, a multitude of bandages, or even from an atrophe of the whole body; from whence alſo the limb ſhrinks or becomes leſs: That theſe and other impediments ought therefore to be ſtudiouſly removed, but more eſpecially the atrophe; partly by more warm or ſpicey aliments, and things which derive the juices to the part, with a ſufficient quantity of nouriſhment and the warm bath, and with whatever elſe tends to render the mind chearful: But the ſigns that the bones are grown firm by and

[q] De Fracturis, textu 43. Charter. Tom. XII. p. 180. [r] Ibid. p. 181.

a callus, are, among others, principally a moiſtening of the bandages, when there is no wound made [f], *&c.* As for what is to be thought of the lapis oſteocolla, and other ſuch remedies, to promote a callus, we have already declared in the comment on §. 347, n° 3.

But the callus with which the fractured bones are conjoined, at length puts on the nature and firmneſs of a bone; inſomuch that we are aſſured from obſervations, that the bone will afterwards break rather in any other part than in the callus or remains of the old fracture. Yet Ruyſch tells us [t], that he found the bones of a hen, which had been broken, to have been conjoined by nature in ſuch a manner, that only the ſpongy ſubſtance of the bone was regenerated, without the hard external lamella, which by its firmneſs naturally defends and ſecures the former. But it is evident, that bones thus conjoined may very eaſily be broken again; and that this caſe ſometimes happens in human bones he is apt to believe, becauſe they are ſometimes broken again by the ſlighteſt cauſes.

There is yet another remarkable obſervation in the ſame author [u], by which it appears, that the ſevereſt pains and ſymptoms may ſupervene in a fracture, tho' all proper care has been taken. For he kept by him two thigh-bones, which had been ſo ill managed after a fracture, that the fragments rid over each other: And what was more remarkable, he found various ſpines or exoſtoſes, many of which being ſharp and ſlender might wound the adjacent parts: and theſe ſpines were not only found about the circumference of the callus of the fracture, but they alſo aroſe from the ſound part of the bone above the fracture, and he perceived ſome of them ariſe out of the ſmall holes into which the tendinous fibres are uſually inſerted; which fibres being tore off from the bone in a fracture or a luxation, he believed might occaſion the like ſpines or exoſtoſes. This opinion of his we find more largely confirmed by ſimilar obſervations on the bones of other animals, which he

[f] Lib. vi. cap. 110. p. 101. [t] Theſaur. Anatomic. 8. n° 49.
[u] In Muſæo Anatomico ſive Catalogo Rariorum, &c. Theca A. Repoſitor. V. n° 1 & 2. p. 129, 130.

there relates. And although it may not be eaſy to foreſee or prevent the like accidents, yet it is thence evident, that we ought not raſhly to impute thoſe conſequences to the ſurgeon, (who may be often one of the higheſt merit) which no art or induſtry can prevent, and which may attend a fracture that has been moſt exquiſitely treated.

Of LUXATIONS.

§. 358. A LUXATION is the receding of the head of ſome moveable bone out of the cavity in which it naturally turned, accompanied with an impediment or loſs of its motion.

A *luxation*, called alſo a [a] *diſlocation*, is the diſplacing of a bone from its natural ſeat; and in this ſenſe it denotes any kind of change in the natural ſite of the bones. But from uſe, which principally determines the ſignification of words, this term has been reſtrained to ſignify only the diſplacing of bones from their articulations where they naturally reſided. But Celſus [b], in treating on luxations, makes a twofold diſtinction of it, when he ſays; *But the bones are moved out of their places two ways. For ſome bones that are joined together, are ſo diſplaced, that there is a ſpace left betwixt them; as when the broad ſcapula recedes from the humerus, and the radius from the ulna in the cubitus, and the tibia from the fibula in the leg, and ſometimes in leaping (though but rarely) the calcaneum from the aſtralagus: In the other way, the heads of the bones are removed out of their places* [b].

Since therefore a luxation, properly ſpeaking, takes place only in the articulated or moveable bones, the definition above given is a very proper one. For in every articulation there are two bones to be conſidered; that which

[a] Cael. Aurelian. Morb. Chronicor. lib ii. cap. 1. p. 347.

[b] Moventur autem ea ſedibus ſuis duobus modis. Nam modo, quæ juncta ſunt, inter ſe dehiſcunt: ut cum latum os ſcapularum ab humero recedit, et in brachio radius a cubito, et in crure tibia a fura; et, interdum ſaltu, calcis os a talo; quod raro tamen fit: modo articuli ſuis ſedibus excidunt *Lib.* viii. *cap.* 11. *p.* 542.

which receives, and the other which is received. The concavity in the receiving bone, which takes in the head of the other bone, is, by the ancients, termed κοτυλην; and the projecting part of the other bone, which is received into that cavity, is termed αρθρον, or simply the joint. Hence we have an excellent definition of a luxation given us by Ægineta[d]; namely, That it is the slipping out of the head of a bone from its proper cavity, into some improper place, whence the voluntary motion thereof is obstructed. For if the motion is not obstructed at the same time, it cannot be properly called a luxation, even though the head of the moveable bone is out of its cavity in which it naturally moves: For in the wonderful articulation of the lower jaw, the round heads of that bone are indeed placed in cavities deep enough, fixed at the bottom of the ossa squamosa, whence the processus zygomaticus arises; and yet, by means of a cartilaginous elastic plate interposed between the heads of the lower jaw, they are allowed to go out of their sinuses, and return into them again, without any injury of their motion. It was even necessary that this articulation should admit of this motion, for the lower jaw to perform its several actions in all manner of directions.

§. 359. WHICH may be done either wholly, or but in part; whence we have a Luxation, and a Distortion.

It is easily conceived that the articulated head of a bone may either slip quite out of its natural cavity, or else be so displaced as to remain partly in and partly out of that cavity. Yet Hippocrates[a] denies that this can take place in all articulations: for he concludes, that as the head of the os humeri and os femoris are round, and are received into cavities of the like shape, they must of necessity either go quite out of their cavity, or if they go out but in part they must slip back again into those cavities. But it is sufficiently evident,

 that

[c] Gorræi Definit. αρθρον, p. 77. [d] Lib. vi. cap. III. p. 101.
[a] De Articulis. Charter. Tom. XII. p. 427.

that this may happen in the other joints. Ægineta, in his definition of luxations, adds: *We have no other differences to mention, except that only which arises from more or less: for the head of a bone slipt perfectly out, is called by the general term* luxation; *but being slightly displaced, or only slipt out to the edge of the cavity, it is termed a* subluxation [b]. It was customary to prefix the preposition παρα, *sub*, before words, to diminish their signification, or denote a slighter affection; whence some physicians say *parapoplexia* for a slighter kind of apoplexy, *paracynanche* for a slight quinsy, *&c.*: And therefore Vesalius [c] seems not to have used these words with proper exactness, when he says that luxations arising from a flux of humours into the articulation are termed παραρθρημαλα; but those from violence, εξαρθρημαλα. For it will appear from what follows, that a true or perfect luxation may arise from a flux of humours into the cavity of the joint. But it is usual to call that species in which it is but partially displaced, a *subluxation* or *distortion*. And yet the term *distortion* also signifies commonly the displacing of muscles or tendons by some external violence; as it also signifies a distraction and twisting of the ligaments from the same cause. Therefore such an imperfect or partial luxation is with less ambiguity termed a *subluxation*.

§. 360. THE worst species of which disorder is, when the epiphysis or head of a bone happens to separate from its diaphysis or body.

In the larger bones which are joined to others by some moveable articulation, it is observable, that each end is distinct from the rest, or body of the bone. This is most conspicuous in the bones of abortive and newborn infants. For these bones themselves were once wholly cartilaginous; and in the middle of their length

a

[b] Differentias alias dicere non habemus, nisi solum illam quæ secundum majus et minus contingit. Omnino enim elapto articulo communi generis nomine εξαρθρημα dicitur; leviter vero dimoto, vel usque ad superficia cavitatis prolapso, παραρθρημα. *Lib.* vi. *cap.* 111. *p.* 101.

[c] Chirurg. Magn. p. 921.

a ſmall round grain of bone firſt began to appear, which ſoon ſpreading itſelf each way longitudinally changes the cartilage into bone [a]. But both extremities of the bone remain a long time cartilaginous; and in the middle of theſe likewiſe the cartilage begins to change into bone, which by degrees ſpreads itſelf throughout the whole maſs. But for a long time after there remains ſomething of a cartilage betwixt the body and end of the bone; as, for example, in the thigh-bone: by which cartilage the end ſeems in a manner to be glued to the body of the bone; till at length this cartilage alſo oſſifies, and cauſes the extremities and body to grow into one continued bone [b]; ſo, however, as to leave ſome mark or diviſion externally for a conſiderable time, till at laſt that mark or line is alſo obliterated [c]. Theſe extremities of the bones, as of the os femoris, diſtinguiſhed by an intermediate cartilage, or a line, from the body of the bone, are called its *epiphyſes*; and in younger animals, theſe epiphyſes are ſeparable by a ſmall force from the body of the bone, as is daily obſerved in the firſt months. But the ligaments which every way inveſt and ſecure the articulations, grow out from thoſe places where the epiphyſes join with the body of the bone: and therefore Columbus [d] would have this to be the principal uſe of the epiphyſes; namely, that the ligaments, which are continued to no other part, might ariſe from their conjunction in thoſe places with the bones. And Havers [e] has alſo obſerved, (as we ſaid in the comment on §. 343.) that in thoſe places whence the ligaments ariſe, the periofteum, which hitherto covered the whole ſurface of the bone, there departs from it, and, climbing over the ligaments which there ariſe, proceeds to the next bone.

If, therefore, the epiphyſis is ſeparated from the body of the bone, it will evidently diſturb the motion of the joint. Yet it does not ſeem ſo proper to call it a *luxation*, becauſe the end of the moveable bone continues in its cavity in which it naturally moves; and

[a] Albini Icones Oſſium Fœtus Humani, &c. p. 101. [b] Ibid. p. 156.
[c] Ibid p. 102. [d] De Re Anatomica, lib. i. cap. 2. p. 5.
[e] Oſteolog. p. 17, 18.

in the definition given at §. 358. it is the receding of the head of the bone from its cavity which conſtitutes a luxation: Whence this diſorder might perhaps have been better referred to fractures. Galen [f] ſeems to reckon it among the ſpecies of fractures, calling it ἀπαγμα; whereas he comprehends the other fractures under the general name κατάγματα: And he obſerves that the word ἀπαγμα is peculiar to phyſicians, being diſuſed by moſt other people; but that it ſignified that ſpecies of fracture, in which the articulating head of the bone is broke off. But as this kind of fracture is often taken for a *luxation*, therefore it is uſually referred hither. But this accident more eſpecially happens in *luxations* of the femur, as they are called; but which are very frequently a ſeparation of the epiphyſis from the body of the bone; or elſe a fracture in the neck of the femur itſelf, which is there very ſmall. For Ruyſch [g] tells us, that a celebrated ſurgeon opened the bodies of eight lame old women, and always found the neck of the femur had been fractured, but never luxated. But ſince in young infants the epiphyſes of the bones are ſeparable by a leſs force, therefore this accident more frequently happens to them: eſpecially if an infant ſuddenly throws its body backward while it is carried in the arms; for then there is great danger of ſeparating the epiphyſis of the femur, or of breaking the neck itſelf of that bone, which occaſions them to be lame afterwards during life, while the body of the bone, being ſeparated from its head, is contracted upwards by the muſcles. But wonderful efforts of nature have been often obſerved, in order to relieve this diſaſter: for Ruyſch found, in the body of an old woman who had this diſorder, that the neck of the femur was quite abſent; and that nature had ſubſtituted various hard, thick, and round ligaments in its place, by means of which the round head of the femur was connected to the reſt of the bone [h]. It is eaſily apparent, that the difficulty is much greater in the cure of this diſorder, than in a luxation properly ſo called; for a luxated bone being

[f] Method. Med. lib. vi. cap. 5. Charter. Tom. X. p. 143.
[g] Ruyſch Theſaur. Anatom. viii. nº 103. [h] Theſauro ix. nº 74.

being reduced in its natural ſeat, is eaſily retained there, provided the limb is at reſt; but when the epiphyſis is ſeparated from the body of the bone, the muſcles inſerted into the bone do by their natural contraction draw it from thence; whence a ſhortening of the limb, and a defect in its motion, almoſt conſtantly follows.

§. 361. THE cauſe of which is ſome extending, diſtorting, or expulſive force acting externally.

No luxation can follow without ſome external force, if the inveſting and articulating ligaments are in their natural ſtate: even a very great force is required to diſjoint the bones in adult and ſtrong people; as is very evident from the ſtrength of the inveſting ligaments of the joints. But any force externally applied will act in one of the three ways mentioned in this aphoriſm.

§. 362. OR ſome internal cauſe, formed in the cavity of the joint, and thruſting out the head of the bone.

The ligaments which connect the articulated bones ariſing from thoſe places where the epiphyſes are conjoined to the reſt of the bone, inveſt the whole articulation in the manner of a capſule or bag, ſo as to form a cavity cloſed on all ſides; nor can they permit any thing to enter from without, nor ſuffer any thing to eſcape from within. In this cavity of every articulation are contained the two ends of the receiving and received bone, incruſted on all ſides with a cartilage; and, in the larger articulations, furniſhed with conſiderable glands, denominated *Haverſian*, from Havers their firſt diſcoverer. One large gland of this kind is ſeated in the articulation of the femur, and four or five ſmaller are viſible in the articulation of the knee [a]. Beſides theſe, there are many ſmaller follicles or drains in the ſurface of the ligament which inveſts each articulation.

[a] Clopton Haverſ. Oſteolog. p. 190,——201.

ticulation. Theſe glands, which by anatomical injections appear to conſiſt of innumerable ſmall veſſels, ſerve to ſeparate and furniſh a mucus, like the white of an egg [b], and of a brackiſh taſte. But the cartilaginous ends of the bones contained in the cavity of the articulation, not being covered with any perichondrium, ſeem to tranſude a thin medullary oil, which is lodged in conſiderable quantities in the cavernous parts of the bones, near their articulations. In the larger bones of a horſe, Dr Havers [c] could perceive theſe pores with his naked eye, through which the medullary oil tranſuded into the cavity of the articulation; and the ſame thing is confirmed by many other experiments. For when the joints of a dead body are preſerved entire, until all the mucilage is gradually conſumed, or perhaps abſorbed, a mere oil is found in their cavities, which the ſame author has alſo obſerved in the joints of the fingers [d]. Animals that are killed, after long and violent exerciſe, have very little medulla in the cavities of the larger bones; whereas in well-fed and idle animals the medulla abounds. From all which it ſeems to be ſufficiently evident, that the medulla of the bones, tranſuding thro' their extremities, mixes with the mucilage ſeparated by the glands; ſo that from a mixture of theſe two is formed that liniment with which the extremities of the articulated bones are anointed and lubricated, that they may ſlide eaſily upon each other without much attrition. And for this reaſon, when the fat or oil is wanting, or conſumed by too much labour, old age, or diſeaſes, a grating or crackling of the joints is perceptible, from the attrition of the too dry ends of the bones againſt each other. Add to this alſo, that the thin dew or vapour is likewiſe diſcharged from the ſmalleſt exhaling arteries into the cavities of the joints, as well as into all the other cavities of the body, whether large or ſmall, with which we are as yet acquainted.

There is therefore a threefold humour meets in the cavities of the joints; namely, the univerſally perſpiring vapours, the medullary oil, and the mucilage ſeparated

[b] Ibid. p. 200, 206. [c] Ibid. p. 173. [d] Ibid. p. 372.

ſeparated by the glands there ſeated: from all which, mixed together, ariſes that lubricating liniment, which, being attenuated by the warmth and mutual attrition of the bones, is returned or abſorbed in the ſame quantity in which it was ſent into the joint. But if the abſorption or return of this liniment is from any cauſe impeded or diminiſhed, while the ſecerning and expulſive cauſes continue, the liniment will be then accumulated ſo as to diſtend and weaken the ligamentary capſule of the joint; whence the prolapſion of the articulated head of the bone from its proper cavity may eaſily ariſe from this cauſe. That tumours of a conſiderable magnitude often ariſe about the joints from this cauſe, is teſtified by innumerable practical obſervations. And Havers [c] demonſtrates, that the medullary oil which tranſudes thro' the cartilaginous ends of the bones into the cavity of the articulation, is very apt to concrete or ſtiffen, if not duly attenuated by the motion and attrition of the bones againſt each other: For he tells us, he has often obſerved this oil ſtagnant and concreted in the pores (thro' which it uſually tranſudes) in ſuch animals as have been fattened without uſing exerciſe; and that at the firſt view he imagined the ſame to be ſmall glands, but he afterwards found them to be nothing more than a concreted oil.

This cauſe of luxations, with many more particulars relating to this diſorder, we meet with in Hippocrates. For in treating on the articulations, he ſays, That all of them are naturally ſupplied with a mucus, which when pure, or of a healthy conſiſtence, the articulations are found, and therefore eaſily moveable, as being ſlippery upon each other. But pain and a difficult motion ariſe in the joint, when the juices flow to it in too great a quantity from a bad habit of body; for the moiſture diſtilled from the veſſels or fleſh is not lubricating, and therefore the articulation will more eſpecially become ſtiff. On the other hand, the articulation will alſo become ſtiff or dry, when the mucus is too abundantly and powerfully diſſipated, and not ſupplied again from the ſoft parts: And when the dried mucus

[c] Ibid. p. 274.

mucus is so redundant, that it cannot be confined within the articulation, it then escapes, and causes a bad concretion or rigidity of the ligaments which connect the joint; which is thus distorted, relaxed, or dislocated; and from hence the patient becomes lame, more or less, according to the degree of the disorder [f]. And, in another place he observes, That in those in whom the head of the femur slip in and out, after being long afflicted with a sciatica, there is an accumulation of the mucus [g].

If now we also consider, that inflammation may arise in these parts, since the ligaments and glands of the articulations appear, from anatomy, to be furnished with innumerable arteries; from hence therefore a suppuration may follow, with an accumulation of the formed matter within the cavity of the articulation, *&c.* and by these means may be produced all those symptoms which arise from the mucilage of the joints accumulating and not being absorbed or returned again into the blood. That luxations very frequently arise from this cause, we are assured by M. Petit [h], who ingenuously confesses that he learned this from his own errors. For when by a fall, or other accident, the trochanter major is urged upwards, it is evident that the head of the femur will be very forcibly pressed into the acetabulum or cavity in which it moves; whence the glands and round ligament there seated may suffer a violent contusion, which we know is often followed with an inflammation, suppuration, and accumulation either of matter or mucilage within the joint. The ligaments being thus distracted and weakened, will be no longer able to retain the head of the femur in its situation: and the muscles inserted in the trochanters drawing the femur upward, will force out the head of that bone from its acetabulum, which will occasion an incurable lameness afterwards. It is hard to discover this disorder at first, as the luxation follows not for a long time. If we know that such a contusion in the joint

[f] De Locis in Homine, cap. 3. Charter Tom. VII. p. 361.
[g] Sect. vi Aphor. nº 59. Charter. Tom. IX. p. 289.
[h] Academ. des Sciences, l'an 1722, Mem. p. 159, &c.

joint has preceded, and there remains a troublesome pain in the articulation; then bleeding, with a thin diet and cooling medicines, are required, to prevent the inflammation, or remove it when present. It will be also very serviceable to keep the part at rest, and apply convenient fomentations: and thus may a luxation be prevented, when it is about to follow from this cause; and which being once formed, seems to be incurable.

§. 363. THESE luxating causes (361, 362.) are assisted by every thing which extends, relaxes, or breaks the ligaments, whether the cause from whence they arise be external or internal.

It is the cohesion of the ligaments only which retains the articulated bones in their proper situations: which ligaments are required to be flexible, that they may give way to the various motions of the joints; and at the same time to be so firm, as not easily to suffer too great elongation. It was before demonstrated, in the commentary on §. 25, nº 3, that too great a distraction is justly specified among those causes which weaken the solid parts of the body; whence too great an extension of the ligaments may dispose the joints to be easily luxated afterwards, though it does not immediately produce the luxation. The same is also true, if the ligaments do not sufficiently resist the distending causes, either through some weakness in themselves, or from a general relaxation of the whole habit. Therefore Celsus[a], in describing the general causes of luxations, says, *Since all the articulations are invested with strong ligaments, they are displaced either by some expulsive force, or from a weakness or rupture of the ligaments by some accident; whence they more easily happen in children and young people, than in those who are strong*[a]. It is universally well known, that the solid parts are weaker and softer, and more easily distracted, in young subjects; though

[a] Omnes articuli, cum validis nervis comprehenduntur, excidunt aut vi expulsi, aut aliqua casu nervis vel ruptis, vel infirmatis; faciliusque in pueris et adolescentulis, quam in robustioribus. *Lib.* viii. *cap.* 11. *p.* 543.

though there are are even ſome adult and otherwiſe ſtrong people, who are found to have a great laxity of almoſt all the ligaments of their joints; and there are often tumblers, or poſture-maſters, that expoſe themſelves for a public ſhew, who by the action of their muſcles only, can luxate almoſt all their joints, and again replace them by the ſame means, ſo as to make their bodies turn almoſt into any ſhape, like a piece of wax. Hence Hippocrates juſtly obſerves, *That there is a great deal of difference in luxations, as to their being more or leſs eaſily reduced, according to the different nature of the joints, the cavity of one being much deeper than that of another, ſo that the bone will more eaſily ſlip out of one than the other. There is alſo a great deal of difference in their connection by the ligaments, ſome of which are lax, and others tenſe,* &c. *And we meet with ſeveral who have their joints ſo moiſt, that they can diſplace them, and reſtore them again when they pleaſe, and that without any pain*[b]. He afterwards adds, that fleſhy joints do not ſlip out ſo eaſily; but then they are more difficultly replaced, when out; whereas in lean people they are more eaſily replaced. He then confirms his diſcourſe by the inſtance of oxen, which being emaciated towards the end of the winter, do very eaſily ſuffer a luxation of the femur.

But if the ligaments have been broken by any external violence, or if their continuity has been diſſolved by any ſuppuration, eroſion, *&c.* it is very evident that then a ſlight force may luxate the joint.

§. 364. HENCE follow an alteration of the figure of the limb, with a tumour, excavation, a ſhortening or an elongation thereof; a diſtraction, immobility, and numbneſs, or palſy of the muſcles below the joint; a compreſſure

b Quod in luxatis facile reſtituendis multum naturæ a naturis differant, et multum cavum a cavo diſtet: nam hoc quidem facilius, illud difficulter ſuperatur. Multum etiam differt nervorum colligatio, quibuſdam laxa, quibuſdam tenſa, &c. Complures autem videre licet, qui ita humidi ſunt, ut, ubi velint, ſine dolore articulos ſuo loco moveant, et ſine dolore reſtituant. *De Articulis, textu* 23, *&c. Charter. Tom. XII. p.* 304, *&c.*

ſure of the adjacent veſſels, followed with pain, watchings, inflammation, an oedema, anchyloſis, convulſion, a withering, and death, either of the part or of the whole body.

This aphoriſm comprehends thoſe ſymptoms which uſually accompany or follow after luxations.

An alteration of the figure, a tumour, or excavation.] Celſus[a], in deſcribing the ſigns which accompany every luxation, ſays, That there is indeed always a tumour in that part to which the bone is thruſt; and a ſinus or cavity in the part from whence it receded. But ſuch an unuſual tumour and preternatural excavation more eſpecially appear when the diſlocated joint is not much loaded with fleſh, as in the ſhoulder and elbow: for in the thigh it is very difficultly diſcerned, becauſe of the many muſcles and circumjacent fat which inveſt the articulation. But in order to determine with certainty whether or not the joint is diſlocated, Hippocrates wiſely directs to compare the injured limb with that which is ſound; and this not by inſpecting the joint of another perſon, (for in ſome people the joints are more protuberant than in others), but by obſerving whether the ſound limb differs from that which is injured in the patient himſelf[b]. But an alteration of the figure alone is not ſufficient to demonſtrate that any joint is diſlocated; for, as Hippocrates likewiſe obſerves, many joints, through pain or ſome other accident, are prevented from reſembling the figure of the ſame joints in healthy bodies, even though they are not diſlocated[c]. Even though a preternatural excavation ſhould appear in the place of the articulation, unleſs an unuſual tumour alſo appears in another part where the head of the bone is thruſt, a perſon may be egregiouſly deceived, eſpecially in the joint of the ſhoulder. Hippocrates[d] even ſays, that he knew ſeveral phyſicians of note, who believed the humerus was luxated, when they ſaw a cavity upon the ſhoulder from

[a] Lib. viii. cap. 11. p. 543.
[b] Hippocrat. de Articulis, textu 34, &c. Charter. Tom. XII. p. 310.
[c] Ibid. p. 311.
[d] Ibid. textu 62, p. 321.

the depreſſion of the head of the humerus below the acromion. And Galen [e], in his commentary on this text of Hippocrates, relates that he had met with the ſame accident in himſelf: For when he was in the field of exerciſe, the maſter of the field perceiving a preternatural cavity in his ſhoulder from the raiſing of the acromion, imagined that the head of the humerus was prolapſed into the axilla; which occaſioned him to extend Galen's arm, and to make a needleſs attempt to replace the bone: but this being done with a violent extenſion made by ſeveral aſſiſtants, Galen himſelf endeavoured with the fingers of his other hand to reduce the head of the humerus; but finding no preternatural protuberance in the axilla, he adviſed them to forbear making any farther extenſion. They, however, continued their extenſion, imagining that Galen requeſted them to forbear by reaſon of the pain; and if one more prudent than the reſt had not come to his aſſiſtance, they would have pulled off the muſcle. But by this perverſe treatment, Galen perceived that a convulſion was beginning to invade his arm, and which he could not keep off but by the continual pouring on of warm oil, as we mentioned once before upon another occaſion in the commentary on §. 164. From hence it is evident, how much caution is neceſſary in order to determine whether a joint is luxated, ſince the moſt ſkilful have been ſometimes miſtaken. Thus I ſaw an unhappy countryman, whoſe whole arm was invaded with a gangrene up to the ſhoulder, which being ſwelled with a true phlegmon, was by an ignorant fellow deemed and treated as a luxation of the cubitus; though by his ſtrong and repeated extenſions, he made the people imagine he excelled every body in the cure of fractures and luxations.

A ſhortening or elongation of the limb.] When the head of the bone is diſplaced from the cavity in which it ought naturally to move, then the muſcles which are inſerted into that bone do naturally contract and draw it upwards; whence it happens, that the diſlocated limb is generally ſhorter than the other, in the manner we

[e] Ibid. p. 322, 323.

we deſcribed in the commentary on §. 343. in treating on the ſhortening of a limb from a fracture of its bones. But in ſome caſes, though not often, the diſlocated limb is elongated; and this happens when the diſplaced head of the bone is ſo ſuſtained, that the muſcles cannot draw it upward. Thus, for example, the lower jaw being luxated on both ſides, as Celſus obſerves, the whole chin will be inclined downward and thruſt forward, the lower teeth will come out much beyond the upper, and the temporal muſcles will be found upon the ſtretch [f]. For the heads of the lower jaw being prolapſed beyond the tubercles which are placed before the cavities of its articulations, they cannot be drawn back by the muſcles of the lower jaw, which will therefore project out beyond the upper jaw. And Hippocrates, treating on luxations of the femur, reckons it one of the ſigns which denote the femur to be luxated inwards, when the injured limb being compared with the other appears longer; for, ſays he, the head of the femur is ſuſtained againſt the bone which is continued upwards from the iſchion to the pubis, and the neck of the femur is ſuſtained againſt the cavity of the articulation [g]: and for theſe two reaſons he judges the diſlocated limb is rendered longer than the other. A ſhortening of the limb will therefore happen the moſt frequently, and yet an elongation of it may likewiſe happen ſometimes. But the caſe is ſtill more rare for the luxated limb to be exactly of the ſame length with the ſound one: yet Hippocrates obſerves, that this may happen, when the head of the femur is diſplaced forwards; though he alſo adds, that ſuch a luxation is ſeldom to be met with.

Immobility.] All thoſe motions, whoſe performance requires the diſplaced joint to be in its natural ſtate, can either not be performed at all, or at leaſt not without great difficulty: and it is certain, that all the motions of a limb cannot be performed in a true luxation, as they were uſually performed when the limb was ſound. As for inſtance, in the articulation of the humerus

[f] Celſus, lib. viii. cap. 12. p. 544.

[g] De Articulis. Charter. Tom. XII. p. 399.

merus in its natural ſtate, a perſon may deſcribe an infinite number of cones with his extended arm, the vertices of all which cones may be conceived to terminate in the cavity of the articulation, while their baſes are deſcribed by the ends of the fingers: but if the head of the os humeri be diſplaced from its articulation with the ſcapula, thoſe motions cannot be performed. The ſame is alſo true of the other articulations. Yet all the motions of a joint are not continually deſtroyed by a luxation; for frequently ſome of the motions remain, as Hippocrates well obſerves. For after having treated of ſuch as have their arms ſhorter from the day of their birth, either from a luxation in the uterus, or from ſome other cauſe, he ſays, *But in thoſe who have a luxation of the humerus in their adult age, without a reduction of it, the upper part of the arm becomes very ſmall, and loſes much of its fleſh: And even thoſe who are free from pain cannot well perform all the actions which require the arm to be raiſed and moved from the breaſt to the ſide: but they are able to perform all ſuch as require the motion of the arm either backwards or forwards towards the breaſt; for they readily uſe the terebra, the ſaw, the ax,* &c. *provided it is not neceſſary to raiſe the arm up very high* [h]. He alſo points out, in ſeveral places of the ſame book, treating of the different luxations, Which of them deſtroy the motion of the joint, and in which of them the motions continue. So that, under theſe reſtrictions, an immobility of the limb is reckoned among the conſequences of luxations.

A diſtraction of the muſcles.] The head of the diſplaced bone muſt neceſſarily preſs upon and diſtract the adjacent muſcles, and at the ſame time the ſituation of the muſcles inſerted into or attached to the bone will be altered; whence ſome of the muſcles will be ſhortened

[h] Quibus vero virili ætate humerus excidit, nec reſtitutus fuit, ſummus humerus attenuatur, et magis excarnis fit; ubi autem dolore liberantur, non æque præſtare poſſunt opera omnia, quæ requirunt, ut cubitus a pectore diductus in latera attollatur. Ad ea autem valent, quæcunque perficienda ſunt, humero vel in priorem partem, vel in poſteriorem, ad pectus adducto: nam terebra, ſerra, ſecure, &c. utuntur, dummodo cubitum non admodum alte attollere neceſſe ſit, &c. *Ibid. textu* 61. *Charter. Tom. XII. p.* 320.

ſhortened and others elongated. And on the ſame cauſe likewiſe depends the change of figure in the luxated limb. M. Petit [i], enumerating the ſigns which denote that the head of the femur is prolapſed backwards, obſerves that the glutei muſcles are relaxed, but that the triceps ſeems like a very tenſe chord extended from the region of the pubis to the middle of the os femoris. When each head of the lower jaw is luxated, it is evident from the anatomical ſtructure of the parts, how greatly the temporal muſcles will be diſtended, *&c.* whence often convulſions and death itſelf follow.

A ſtupidity or numbneſs of the ſubjacent parts, or a palſy.] Theſe happen when the prolapſed head of the bone compreſſes the large nerves adjacent; or as when the ſpinal medulla itſelf is compreſſed by a luxation of the vertebræ. Hippocrates [k], in treating on a luxation of the ſpine, obſerves, that when the upper part of the ſpine is diſlocated inwards, the whole body becomes ſtupid and relaxed (νενάρκωμενοι) or paralytic. See what has been ſaid in the commentary on §. 170. I. 3. If now the head of the os humeri ſlips into the cavity of the axilla, it will compreſs the large trunks of the nerves which are there ſeated, whence it is evident that theſe ſymptoms will invade the parts below. When the head of the os femoris is luxated forwards, among other ſigns of its being ſo luxated Hippocrates [l] reckons a ſuppreſſion of urine, becauſe then the head of the femur will be near the large nerves. But it would rather ſeem, that a compreſſion of the nerves ſhould produce an involuntary diſcharge inſtead of a ſuppreſſion of the urine. But Hippocrates [m] in another place takes notice, that if the ſpinal medulla is injured by any cauſe, at the firſt the patient neither voids the urine nor fæces; but when the diſorder becomes inveterate, he diſcharges them both without his inclination: from whence it appears, that a ſuppreſſion of urine may ſometimes follow a compreſſion of the nerves. If therefore the nerves deſtined to ſenſe and motion are entirely com-

[i] Academie des Sciences, l'an 1722. Mem. p. 163. [k] De Articulis. Charter. Tom. XII. p. 390, 391. [l] Ibid. p. 422, 423.
[m] Prorrhetic. lib. ii. cap. 11. Charter. Tom. VIII. p. 819.

preſſed, it will form a complete palſy with inſenſibility; but if the compreſſion is only ſlight, it will impair, and not totally aboliſh all the functions of the nerves; the ſubjacent parts will then ſuffer a *torpidity*, as Galen[n] well expreſſes it, being a diſorder betwixt the palſy and perfect health of the parts.

A compreſſure of the adjacent veſſels.] In the ſame manner as the head of the os humeri, prolapſed towards the axilla, often compreſſes the adjacent large nerves, ſo may it likewiſe compreſs the adjacent large blood-veſſels which are there ſeated; and thus it may impede the influx and reflux of the blood to and from the ſubjacent parts, whence may follow a gangrene or a withering. See what has been ſaid on this head in the commentary on §. 161 and 166.

Pain.] Such a diſpoſition of a nervous fibre ariſing from the brain, as threatens a rupture or ſolution of its continuity, excites the idea of pain in the mind, as we ſaid before in §. 200. Now a joint cannot be diſlocated without a violent diſtenſion of the ligaments inveſting the articulation; and ſo long as the bone remains diſplaced, ſo long will the ligaments be diſtended beyond their natural ſtate: from whence pain, and that in no ſmall degree, always accompanies every recent luxation; and which pain generally ceaſes, or at leaſt much abates, ſo ſoon as the bones are replaced. Hence, therefore, luxation is deſervedly reckoned among the cauſes of pain §. 224, n° 3. If now we alſo conſider, that the perioſteum departs from the bones at their articulations, and continues on its courſe over the ligaments (ſee the commentary on §. 343.) it will evidently appear, that the ligaments cannot be diſtracted without ſtraining the incumbent perioſteum in like manner; which being extremely ſenſible, may be another cauſe of pain. Beſides, the head of the luxated bone, by preſſing upon the adjacent parts, will diſtract the nervous fibres there diſperſed; and the blood-veſſels of the ſame parts being alſo thereby compreſſed, will be liable to obſtruction, inflammation, *&c.*: Whence new ſources of pain preſent themſelves. But when the diſlocated bone has

[n] De Locis Affectis, lib. ii. cap. 4. Charter. Tom VII. p. 404.

has not been replaced for ſome time, the ligamentary fibres are ſo weakened by the continual diſtraction (ſee §. 25, n° 3.) that they more eaſily yield or elongate without danger of breaking; whence the pain is gradually diminiſhed, and at length ceaſes, (ſee §. 228, n° 1.) and the circumjacent parts, which have been compreſſed and rubbed for ſo long a time by the diſlocated head of the bone, become at length callous and inſenſible. We obſerved before, in ſpeaking of the immobility which follows luxations, that thoſe are at length freed from their pain who have not had the diſlocated bones reduced, and that they can alſo perform various motions of the joint eaſily enough. And Hippocrates, in treating on a luxation of the femur outwards, ſays, *The fleſhy parts, into which the head of the bone has receded, become at length tough or callous by the attrition, and the pain in time ceaſes: And when the patients are free from pain, they are capable of walking without a ſtick, if they ſo pleaſe; and the weight of the body may be ſuſtained by the affected thigh*[o]. For as Gorræus [p] obſerves, the word γλιχρον, *tenax*, denotes in the ſolid parts a *toughneſs* or *calloſity*; but in the fluids, a *lentor* or *viſcidity*.

Watchings.] In the commentary on §. 226, we reckoned *vigilia* or watchings among the effects of pain; and as it was before proved, that pain accompanies a luxation, it is evident that watchings ought to attend likewiſe, ſo long as the intenſity of the pain continues.

Inflammation.] It will appear, under the ſubſequent title, that an inflammation attends whenever the impervious juices ſtagnate in the ſmaller veſſels, and are urged on behind by the increaſed force of the circulation in a fever, by which the juices are preſſed and ground together. Here therefore are neceſſarily ſuppoſed an obſtruction and a quicker circulation of the humours. But in the commentary on §. 112. it was demonſtrated, that any force, which compreſſes or elongates the flexible veſſels, diminiſhes their capacity, and

[o] Ubi caro, in quam articulus exceſſit, jam trita eſt, et tenax evaſit, dolor tempore ceſſat. Quando autem dolore liberi ſunt, ingredi ſine baculo poſſunt, ſi alioquin velint, poteſtque affecto crure ferri corpus. *De Articulis. Charter. Tom. XII. p.* 411.

[p] Definit. Med. p. 133.

and may therefore be the cauſe of obſtruction. Now, in a luxation, the ligaments, tendons, and muſcles, attached to the bones, are elongated; and the diſlocated bones compreſs the adjacent ſoft parts: hence an obſtruction may follow as the effect of a luxation. But a fever is reckoned among the effects of pain, (on §. 226:) from whence it is evident, that thoſe two cauſes attend in luxations, which are ſufficient to produce inflammation; namely, obſtruction, and a ſwifter motion of the blood ariſing from the fever and pain which accompany every luxation. But how violent the fever and pains are, which follow from luxations, is taught in ſeveral places by Hippocrates. Thus he obſerves, that the os humeri being luxated forwards at its articulation with the cubitus, is followed with moſt violent and intenſe inflammations, if it is not immediately reduced; but when it is diſlocated backwards, it occaſions moſt ſevere pains and a violent fever, with a diſcharge of real bile, and proves fatal in a few days [q]. And the ſame he affirms, in treating on a luxation of the cubitus, in his Book of the Articulations [r]. And in another place, treating on a luxation of the jaw, he obſerves [s], that it ought to be reduced with the utmoſt expedition; for if it be not replaced, the patient's life will be in danger from the continual fever: and he then adds, that theſe patients uſually void pure bile in ſmall quantities by ſtool; and if they vomit, they bring up the like humour.

Oedema.] It was ſaid in the commentary on §. 112, n° 1. that by this name even all preternatural tumours were called formerly; but that afterwards it was reſtrained to thoſe tumours only which are ſoft, indolent, and yield to the preſſure of the fingers. Such a kind of tumour is generally ſeated in the cellular membrane only, from an accumulation of the lymph ſtagnating in the cells of that membrane. But luxations are generally accompanied with this tumour, when the diſlocated bone compreſſes the larger veins; for thus the motion of the venal juices is impeded, ſo that the thin

[q] Hippocrat. de Fracturis, in fine libri. Charter. Tom. XII. p. 266, 267. [r] Ibid. p. 331. [s] Ibid. p. 340.

thin dew exhaled by the arteries into the cavities of the cellular membrane cannot be duly abſorbed by the veins; whence being accumulated and ſtagnant, it is converted into water or *ichor*, as it is termed by Hippocrates.

Anchyloſis.] Celſus [t] tells us, that joints contracted with a recent cicatrix or callus were by the Greeks termed αγκυλας: but that a ſtiffneſs or immobility of a joint was alſo called αγκυλας and αγκυλωσεις, we are told by Ægineta [u]; and that the cauſe was an infarction of the humours, or a contraction of ſome of the ligaments. *Anchyloſis* therefore denotes an inflexibility of a joint, which is frequently accompanied with a preternatural tumour. Now, for the joints to continue moveable, it is neceſſary for the heads of the bones to retain their proper figure and connection where they are articulated together; and to have their extremities evenly covered with a very ſmooth cartilage, lubricated with the proper liniments; and laſtly, the ligaments themſelves, which encompaſs the joint, muſt have a due degree of flexibility. But by luxations all theſe requiſites are ſometimes either deſtroyed or perverted. For the ligaments, being broken or violently diſtracted by the diſlocation of the bone, become inflamed; as they alſo may from that force which is required to extend the bones and reduce them: And this inflammation may terminate either in a ſuppuration or a gangrene; whence the ligaments will afterwards remain rigid and contracted. Alſo this diſorder of the ligaments will impair the ſecretion of the lubricating mucilage of the joint, which will be leſs than uſual; whence again the motion of the joint will be impeded. While the ligaments are inflamed, moſt ſevere pains will ariſe from the leaſt motion of the joint; which being therefore kept at reſt, the liniment of the joint will not be ſufficiently attenuated and abſorbed: this therefore being accumulated, and deprived of its more thin and fluid parts, will at length concrete into an irreſolvable maſs, which will totally deſtroy the motion of the joint. If again the ſurface of the cartilage is wounded

[t] Lib. v. cap. 18. nº 28. p. 257. [u] Lib. iv. cap. 55. p. 70. verſa.

ed or abraded either in the diſlocation or reduction of the head of the bone, or is any other way injured, this may be another cauſe of an anchyloſis.

Convulſion.] The moſt acute pain, diſturbing the whole common ſenſory, is frequently attended with convulſions, as was ſaid before in §. 226.; and from hence a convulſion may follow a luxation. But beſides this, a luxation is often accompanied with a conſiderable diſtortion of the muſcles, and diſtraction of the tendons; which alone may be ſufficient to produce a convulſion: For we know by daily experience, what a ſevere pain and contraction of a muſcle follows, commonly called the *cramp*, when any of the tendons of the muſcles moving the fingers or toes are diſplaced. Hippocrates [w] obſerves, that in a luxation of the bones of the leg, accompanied with a wound, if the heads of the bones next the foot are perfectly diſlocated either outward or inward, they ought not to be reduced; for if they are reduced, the patient ſurvives but a few days, and expires with convulſions. The ſame bad conſequence is to be expected, he ſays [x], if the bones of the cubitus are ſo diſlocated at the wriſt, that they burſt out thro' a wound: and he then adds [y], that if a convulſion follows the reduction of the bones, they ought ſpeedily to be diſplaced again, and the parts muſt be afterwards fomented at times.

A withering.] When the larger arteries or nerves tending to any part are from ſome cauſe obſtructed, ſo that they cannot properly diſtribute their reſpective juices neceſſary for the life and nutrition of the parts, a true maraſmus or waſting of thoſe parts thence follows; ſince all the veſſels are contracted and collapſed, from their juices being diſſipated, without any freſh ſupplies. A ſurpriſing inſtance of ſuch a withering is related in the commentary on § 161. where the axillary artery being totally divided, the whole arm afterwards dried up like a mummy. When therefore, for inſtance, the head of the os humeri is ſo prolapſed as to compreſs thoſe large veſſels in the axilla for a conſiderable time, it

[w] De Articulis. Charter. Tom. XII. p. 435. [x] Ibid. p. 443.
[y] Ibid. p. 445.

it is evident that the like accident may be apprehended.

But Hippocrates has alſo remarked another cauſe of this withering; namely, when the diſlocated bones have not been reduced. For, in treating of a luxation of the femur, he ſays, that if this happens to thoſe who are not yet grown to their full ſtature, and no reduction has been made, the thigh, leg, and foot, is by that means rendered ſhorter: for then the bones are not equally augmented in their length; but they, and eſpecially the femur, become ſhorter. The whole leg alſo becomes feeble, ſlender, and almoſt without fleſh or muſcles; partly becauſe the limb is diſlocated, and partly becauſe its functions are diſturbed or aboliſhed, from its veſſels being not naturally diſpoſed: For the uſe of any limb that is feeble corroborates it; but every thing which prevents the growth or elongation of the limb, cauſes it alſo to decay or waſte. But thoſe have this injury in the moſt conſiderable degree, who have ſuffered a diſlocation of the femur while in the uterus; and next, thoſe to whom this has happened when they were very young; but thoſe are the leaſt injured hereby, who are already ſtrong and luſty [z]. But this withering, he obſerves [a], is chiefly ſeated in the parts neareſt to the diſlocated joint: which he proves by the inſtance of thoſe who have had a diſlocation of the humerus from the birth, or at leaſt before they have acquired their full growth; for in theſe the humerus is ſhorter, and the cubitus, with its adjoining hand, ſomething leſs, than the ſound. He likewiſe adds, that they can generally perform moſt kinds of work almoſt as well with the injured as with the ſound limb: But when the head of the femur is diſlocated inwards, he ſays, that the fleſh is waſted the more, becauſe they cannot uſe the limb. Hence that withering which follows the diſlocation of a joint that has not been reduced, cannot be always aſcribed to the compreſſion of the larger veſſels, but it often reſults likewiſe from the defect of the muſcular motion in the limb thus injured: and therefore Hippocrates remarks, that when the femur is diſlocated outwards in adults, and has not been reduced, the

[z] Ibid. p. 403. & ſeq. [a] Ibid. p. 408.

the bulk or fleſhineſs of the parts is not ſo much diminiſhed, becauſe the limb does not loſe its motions or uſe; for the fleſhy parts, amongſt which the head of the bone is protruded, become at length tough and firm by attrition, ſo that the patient can ſtand or walk on it without a ſtick [b]. But after this, he deduces a general axiom from theſe obſervations, and ſays: *Every part of the body made for ſome action, being moderately uſed, and exerciſed in that ſort of work to which each part is accuſtomed, does by that means become healthy, increaſe in bulk, and conduce to a good old age: But if they remain idle, and without exerciſe, they become more diſeaſed, do not grow luſty, and bring age on apace; and this holds true principally in the ligaments and joints, unleſs a perſon uſes them* [c]. But what a conſiderable effect exerciſe has in reſtoring, from the aliments, thoſe parts which are continually waſted by the actions of a living and healthy body, has been already demonſtrated in the commentary on §. 25, nº 2. and §. 28, nº 2. If again we alſo conſider, that the tendons, muſcles, ligaments, *&c.* contract or ſhorten, and at length become rigid, if they are not moved; and that the veſſels of our bodies collapſe, and cloſe by their own contractile power, from a diminution of their diſtending cauſes; it will be from thence evident, why the parts ſhrink or waſte after the motion of a limb is impeded by a luxation.

All that Hippocrates has ſaid in different places concerning this withering of the parts, is collected together by Celſus, and expreſſed in a manner no leſs conciſe than elegant: *As to limbs which have been diſlocated in childhood, and which have not been replaced, they grow leſs than the reſt: for the fleſh or muſcles of every diſtorted limb conſumes or falls away, and this more in the parts near the luxation than in thoſe which are more remote: As for inſtance, if the humerus is diſplaced, the*

[b] Ibid. p. 411.

[c] Quæcumque in corpore ad aliquem uſum facta ſunt; ſi quis moderate utatur, exerceatque in eo laboris genere cui ſingula aſſueverunt: hoc pacto bene valent, augentur, et ad bonam ſenectutem deducuntur. Si in uſu non ſint, ſed otioſa maneant, morboſiora fiunt, non augentur, et brevi ſeneſcunt: id præcipue accidit, nervis atque articulis, niſi quis illis utatur. *Ibid. p.* 42.

there happens a greater waſting in that than in the fore-arm, and a ſtill greater in the fore-arm than in the hand. Add to this, that more or leſs of the action of the limb remains, according to the different ſeats and cauſes of the luxation; and likewiſe, the more the action of the limb remains, the leſs is it extenuated or waſted [d].

The obſervations of the moſt ſkilful ſurgeons likewiſe confirm this doctrine. A youth ſitting down in a meadow, was drawn by the leg by a playful girl; whereupon a pain in the articulation of the femur enſued, which was yet but ſlight. A very ſkilful ſurgeon being called, upon the ſtricteſt examination could find no ſigns of a luxation, but imagined the pain aroſe from the diſtraction of the muſcles and ligaments inveſting the articulation; and therefore he only applied ſome linen-cloths dipped in ſpirit of wine to the affected parts, and retained them by a ſuitable bandage. The careful mother, who expected to have ſeen a much more formidable apparatus uſed, called in a country-fellow, who was by the ignorant common people believed to be a great maſter in reducing luxations. The ruſtic ſo forcibly extended the falſely ſuppoſed diſlocated limb, that he actually diſplaced the head of the femur inwards from its cavity; as it evidently appeared, after the ſevere pain, tumour, and inflammation of the parts were removed by proper remedies: For the injured leg was two inches longer than the ſound one. As the patient was not yet arrived to his full growth, the ſurgeon predicted that there would be a deficiency in the future growth of the injured limb in proportion to that of the reſt of the body: the truth of which aſſertion was afterwards proved by the event; for when the whole body was grown four inches higher, the injured leg was about two inches ſhorter than

[d] Ac, quibus in pueritia exciderunt (articuli), neque repoſiti ſunt, minus quam cæteri creſcunt; omniumque, quæ loco ſuo non ſunt, caro emacreſcit, magiſque in proximo loco quam in ulteriore; ut puta, ſi humerus loco ſuo non eſt, major in eo ipſo fit macies, quam in brachio; major in hoc, quam in manu. Tum pro ſedibus, et pro caſibus, qui inciderunt, aut major aut minor uſus ejus membri relinquitur: quoque in eo plus uſus ſupereſt, eo minus id extenuatur. *Lib.* viii. *cap.* 12. p. 544.

the ſound, notwithſtanding they were at the reduction both of the ſame length [e].

Death of the part, or of the whole body.] Among the effects or conſequences of pain, we reckoned a gangrene, §. 226. which is that ſtate of the ſoft parts in which they tend to death or mortification, by being deprived of their vital influx of blood by the arteries and reflux by the veins. The ſame diſaſter alſo frequently happens from a violent inflammation, which is ſo general an attendant on luxations. When the bones of the leg are diſlocated at the foot with a wound, Hippocrates [f] obſerves, that to attempt a reduction would cauſe a gangrene to invade the leg and foot. If therefore the larger veſſels are ſo compreſſed by the luxation as to intercept the vital influx and reflux of their juices, a death or mortification of the part is at hand: as it alſo is when the reduction of the bones is attempted while the violent inflammation continues; for the ſtrong extenſion and rough handling which are required in the reduction, often cauſe the inflammation to turn ſpeedily to a gangrene. An unfortunate caſe of this nature is related by the ſagacious author [g] lately cited. An unſkilful perſon attempted to reduce the elbow, which had been diſlocated in a ſervant-man the day before, and this notwithſtanding a violent inflammation occupied the adjacent parts of the articulation; and he called in to his aſſiſtance two ſtrong men, who moſt violently extended the part. By the next day a gangrene had extended itſelf up to the middle of the arm, and the patient's life could be ſaved no other way than by amputating the limb. But that death itſelf, even of the whole body, is likewiſe often the conſequence, may ſufficiently appear from what has been already ſaid in the commentary on this aphoriſm: for we obſerved that a luxation of the jaw is often attended with violent convulſions and death; and Hippocrates obſerved, that violent fevers ariſe after a diſlocation of the cubitus. The ſame he alſo obſerves,

[e] De la Motte Traite Complet de Chirurgie, Tom. IV. p. 367,—375.
[f] De Articulis, Charter. Tom. XII. p. 437.
[g] De la Motte, &c. Tom. IV p. 359.

ſerves, when the larger bones are ſo diſlocated that they ſtart through a wound: for then convulſions and death are at hand if they are replaced; and if they are let alone, even then life is often in danger.

§. 365. FROM a knowledge of all which ſymptoms, we are furniſhed with the demonſtrative ſigns of a preſent luxation.

To be ſatisfied of the luxation of any joint, the firſt inquiry muſt be, Whether a cauſe ſufficiently violent has preceded, by the force of which the head of the bone might be diſplaced: and, Whether this cauſe was external, (§. 361); or internal, reſiding in the cavity of the articulation, (§. 362). And then inquiry muſt be made, Whether the articulating ligaments have been overſtrained or broken by a too violent external force preceding; or whether the ligaments are ſo relaxed from any cauſe, that they do not firmly retain the joint which they inveſt, of which we ſpoke in §. 363. After it has appeared from hence that there is juſt ground to ſuſpect a luxation, we muſt diligently inquire after thoſe ſigns which demonſtrate that a luxation is preſent. And the chief of theſe are, A preternatural tumour, from the head of the bone being diſplaced into ſome other part; and, An unuſual cavity in the place where the head of the bone was naturally ſeated. But to make the diagnoſis certain, both theſe ſigns ought to attend; for either of them alone is often found fallacious. We gave an inſtance, in the commentary on the preceding aphoriſm, of ſuch an error committed on no leſs a perſon than Galen himſelf, whoſe humerus was miſtakenly ſuppoſed to be luxated from the appearance of a preternatural cavity made by the diſtortion of the acromion, without any unuſual tumour appearing in the adjacent parts. And thus I myſelf ſaw an inflammatory tumour, formed in the groin by a fall, miſtaken for a luxation of the femur; when at the ſame time, the girl being of a lean habit, one might eaſily perceive by the touch that the articulation was right, and that there was no preternatural cavity. It

is a ſtrong confirmation of the diagnoſis, when the motion of the limb, which depends on the natural conformation of the joint, is totally deſtroyed, or elſe very much depraved: And if at the ſame time, by comparing the injured limb with that which is ſound, there appears a conſiderable difference in their figure and length, there ſeems then to be no room to doubt of a luxation.

The diagnoſis of a luxation is however ſometimes very difficult: for if the inflammation ariſing from a violent contuſion, diſtortion, *&c.* has cauſed a conſiderable tumour to be formed round the joint, it will be neither eaſy to perceive the protuberance nor the preternatural cavity which is there formed; while at the ſame time all the motions of the joint are prevented by the intenſe pain. In ſuch a caſe therefore, one ought chiefly to conſider whether the antecedent cauſe was ſuch, as that one might from thence reaſonably expect a luxation. Nor will it be of any bad conſequence to ſuſpend our judgment in ſuch a doubtful caſe; becauſe the violence of the inflammation will render it dangerous to reduce the luxation: therefore that ought to be firſt removed by proper remedies, and then the affected parts may be more diſtinctly examined.

But how much caution is often required in diſtinguiſhing luxations, is evident from the caſe which Galen [a] relates. A man diſlocated his arm in the field of exerciſe: the phyſician, upon comparing the injured limb with that which was ſound, could perceive no difference; whence he too haſtily concluded that the part was hurt with a contuſion, but that the articulation was ſound. He therefore ordered the patient to the bath; and, after covering the part with woollen-cloths dipped in wax and oil, to compoſe himſelf to reſt. But as by theſe means the pain did not abate all night, on the day following, the phyſician full of indignation (becauſe others more unſkilful than himſelf were conſulted) readily confirmed and perſiſted in the diagnoſis which he made the day before; and ſaid, that the humerus

[a] In Commentario primo in librum Hippocrat. de Officina Medici. Charter. Tom. XII. p. 6.

merus was inflamed by the pain, and that therefore he would have the ſame means continued. But on the third day, the pain being nothing abated, and Galen being called into conſultation, he found indeed that the affected ſhoulder had no preternatural cavity in the place of the articulation, but that it was rather more tumid than the other ſhoulder; but thruſting his fingers under the axilla, he immediately perceived the head of the humerus was lodged there, and therefore determined there was a luxation. It was the compariſon of the injured limb with that which was ſound, which deceived the firſt phyſician; whereas, upon Galen's inquiry, the patient owned, that by a fall from a chariot he had formerly broke off the acromion of the other ſhoulder, which the phyſician ſuppoſed to be ſound and natural, though it had thence an apparent excavation; ſo that the compariſon of the two ſhoulders together, in each of which the ſame cavity appeared, led the firſt phyſician into an error.

After the exiſtence of the luxation is aſcertained, it is farther required in the diagnoſis to determine towards which part the bone is prolapſed; whether inwards, outwards, upwards, downwards, *&c.*; for many things neceſſary towards the prognoſis and cure depend on this determination. Much light will be afforded in this affair from the anatomical knowledge of the various connections and articulations of the bones, with a conſideration of their movements reſulting from the particular diſpoſition of each joint. But the particular quarter towards which the head of the bone is diſplaced, may be alſo determined from the ſame conſideration of their motions; and therefore Hippocrates, and all the beſt proficients after him, have very diligently collected all the ſigns by which one may diſtinguiſh the different modes of diſlocation in the ſame joint. Thus, for inſtance, he obſerves, that if the injured arm cannot be extended, the cubitus is diſlocated backwards; and, on the contrary, that when then the joint is luxated forward, the cubitus cannot be inflected [b]: and in treating on the ſeveral luxations of the femur, he

[b] Hippocrat. de Articulis. Charter. Tom. XII. p. 331.

accurately remarks the ſigns proper to each[c], *&c.* which ſeem unneceſſary to be here repeated.

§. 366. AND from having conſidered the ſize, figure, and ſituation of the accident, with the intercepted or compreſſed parts; the age of the diſlocation, and its degree of concretion; with the pain, inflammation, convulſion, or other ſymptoms in the circumveſting parts, which are of a more or leſs ſlender or groſs texture; alſo the ligaments themſelves, being either broken or elongated, with their annexed muſcles, *&c.*: From all theſe is deduced a prognoſis, indicating whether the cure will be complete or defective, ſpeedy or ſlow, eaſy or difficult.

After the luxation is apparently demonſtrated by the diagnoſtic ſigns, every circumſtance mentioned in this aphoriſm ought then to be duly conſidered, in order to form a certain prognoſis of the bad conſequences that may be feared from the known luxation, or from that force which will be neceſſary to reduce the diſlocated bones: For all theſe ought to be intimated, at leaſt to the patient's friends, if not to himſelf; leſt the ſupervening accidents, which are by no means avoidable, ſhould be imputed rather to ignorance or neglect in the ſurgeon, than to the violence of the diſorder. But the principal inquiry in the prognoſis is, Whether ſuch a cure may be expected, that the limb will afterwards recover all its uſual motions; or whether only ſome of the uſual motions of the diſlocated limb will remain, and thoſe not abſolutely the ſame as they were before the luxation. For thus is diſtinguiſhed whether the cure will be *complete* or *defective*. It ought alſo to be further determined, whether the cure may be compleated in a ſhort ſpace of time, or whether a longer interval will be required to reſtore the limb to its due ſtrength. For if (for example) the ligaments have been violently ſtrained, or otherwiſe relaxed, ſo as to loſe their

[c] Ibid. p. 398. et ſeq.

their ſtrength before the accident, a ſpeedy cure cannot be expected. Further, the cure may be ſaid to be *eaſy* when only a ſlight extenſion is neceſſary to reduce the luxation, which is not attended with any very bad ſymptoms: But, in the contrary caſe, one may juſtly foreſee, that the cure will be attended with difficulty when it requires a violent extenſion, and moſt or all of the aſſiſtances of art. "It is the buſineſs of a quack "to magnify a ſlight caſe, that his performance may "appear the more conſiderable," ſays Celſus [a]. Yet it can never be amiſs to repreſent the prognoſis rather on the more difficult ſide: for if the ill conſequence ſupervenes, they will reflect that it was predicted to them; but if every thing ſucceeds well, the happy event will merit praiſe to the ſurgeon. But what conſequences are to be feared, will be evident from the following conſiderations:

Size or magnitude.] The magnitude of a luxation is meaſured by the diſtance which is intercepted betwixt the head of the bone and the cavity from whence it was diſplaced. Now it is evident, that the farther a bone has receded from its cavity in which it naturally moved, the more will the inveſting ligaments be diſtended, even ſometimes to a rupture; and the greater diſtraction alſo will the adjacent tendons and muſcles ſuffer; whence extreme pain, inflammation, *&c.* follow. It is alſo equally evident, that a luxation may be the more eaſily reduced, as the head of the bone is nearer to the cavity from whence it was diſplaced: Whence Celſus obſerves [b], it will be much more eaſy to reduce the humerus when it is diſlocated forwards, than when its head is prolapſed into the axilla.

Figure.] It was ſaid before (on §. 364.) that a luxation is attended with an alteration of the figure of the limb: Therefore the greater this alteration, which is obſerved by comparing the ſound and injured limb together, ſo much the greater change is there in the ſituation of all the circumjacent parts, and ſo much greater is their extenſion or diſtortion; all which will apparently

[a] A. C. Celſi Medic. lib. v. cap. 26. p. 283.
[b] Lib. viii. cap. 15. p. 549.

rently augment the difficulty of the cure. But the figure of the diſlocated joint itſelf may cauſe a great deal of difference in this reſpect. As for inſtance, in a diſlocation of the humerus, if the head of the bone is lodged before its proper cavity, by relaxing the parts after a due extenſion is made, the bone eaſily ſlips into its place. But, in the os femoris, the caſe is very different. For the head of that bone, with its ſlender neck, forms an obtuſe angle with the reſt of the deſcending body of the bone; whence it will be here neceſſary to uſe another artifice. For though, by a forcible extenſion, the diſplaced head of the bone may be brought over-againſt its proper cavity; yet it may very eaſily ſlip upwards and paſs over its laterally-placed cavity: whence Hippocrates[c], treating of the reduction of the os femoris when diſlocated inwards, ſo diſpoſes the whole apparatus, as that the ſurgeon's hand may preſs laterally, and urge the bone into its place when the head comes over-againſt its cavity.

Situation.] If we conſider thoſe wiſe obſervations which Hippocrates[d] has made concerning the different directions of a luxated femur, it will ſufficiently demonſtrate what a conſiderable difference may ariſe from this cauſe only, in the effects of a luxation. For if the femur is diſlocated inwards, and cannot be replaced, as it frequently happens; then the muſcles or fleſh which encompaſs the diſlocated bone fall away, and the action of the limb will be much vitiated: But the ill conſequence will be much leſs if the head of the femur is diſlocated outwards. And therefore Hippocrates makes this general inference; *With reſpect to the hip or joint of the femur, there is a great deal of difference, according as it is luxated either inwards or outwards; and with reſpect to that of the knee, there is alſo a difference, but leſs than in the former. But there is a particular mode of halting proper to each of theſe: for thoſe who have the femur diſlocated outwards, have their leg turned rather inwards; but thoſe ſtand leſs upright, who have the femur luxated inwards. The ſame likewiſe holds in a laxation of the ankle: for if the foot be diſlocated outward,*

[c] De Articulis. Charter. Tom. XII. p. 455. [d] Ibid. p. 399. et ſeq.

outward, they can ſtand, and are termed vari; *if it be diſlocated inwards, they cannot ſo well ſtand, and they become* valgi [e].

The parts compreſſed or intercepted.] What ſad diſorders may follow, when diſlocated bones compreſs the adjacent parts, is no where more evident than in a luxation of the vertebræ of the ſpine; for then the ſpinal medulla included within their cavity is compreſſed, contuſed, and ſometimes wounded. And here the conſequences are always more fatal, as the luxation is ſeated higher up towards the head; and therefore a luxation of the head itſelf (by the ſlipping back of its glenoide proceſſes, by which it is connected to the uppermoſt of the vertebræ) is by Celſus juſtly pronounced fatal: *The nerves below the occiput are extended or obſtructed; the chin is preſſed cloſe to the breaſt; nor can the patient either drink or ſpeak; and ſometimes there is an involuntary diſcharge of the ſemen; which ſymptoms are ſoon followed with death* [f]. And he afterwards obſerves [g], that thoſe are much in the ſame condition who have a luxation of the vertebræ of the ſpine, but that they do not die ſo ſoon as one who has had the head luxated; yet that they die within three days time. He alſo there enumerates thoſe very bad conſequences which follow a perfect luxation of the vertebræ; that is, when they are wholly diſplaced: for then he ſays, the ſpinal medulla, its membranes and nerves, muſt of neceſſity be ruptured. But if the vertebræ are only diſtorted a little outwards, he propoſes a method of cure out of Hippocrates. See alſo, upon this ſubject, what has been ſaid in the commentary on §. 364.

[e] Circa coxas magna differentia eſt, verſus interiora aut verſus exteriora, luxatum eſſe: circa genua quidem differet, ſed minus. Modus autem claudicationis utriſque proprius eſt: nam quibus in exteriorem partem procidit, vari magis fiunt; minus autem recti ſtant illis, quibus in interiorem partem luxatur. Similiter autem et ſi circa talum luxatio facta fuerit; ſi enim verſus exteriorem partem, vari quidem fiunt, ſed ſtare queunt. Si verſus interiorem partem exciderit, valgi quidem fiunt, minus vero ſtare poſſunt. *Ibid. p.* 406.

[f] Nervi ſub occipitio extenduntur, et mentum pectori agglutinatur; neque bibere is, neque loqui poteſt: interdum ſine voluntate ſemen emittit: quibus celerrime mors ſupervenit. *Lib.* viii. *cap.* 13. *p.* 546.

[g] Ibid. cap. 14. p. 547.

§. 364. concerning the numbneſs and palſy of the parts below the diſlocated joint. But if, in reducing the diſlocation, the parts of a nerve, tendon, muſcle, blood-veſſel, or the like, ſhould be unfortunately intercepted betwixt the bones, it is evident that the moſt excruciating pains, convulſions, *&c.* may thence follow. But ſuch an interception cannot eaſily happen, if a due extenſion of the parts precedes the reduction of the luxation.

Age or continuance.] Hippocrates [h] lays it down as a general rule, That luxations ought to be reduced immediately, or at leaſt as ſoon as poſſible. For he obſerves, that the reduction may be more eaſily made before the part begins to ſwell, and the patient will then likewiſe ſuffer leſs pain. And the moſt celebrated ſurgeons, who always provide their whole apparatus of dreſſings in order, before they reduce a fracture, do nevertheleſs immediately reduce a luxation, and then provide the neceſſary bandages and other things proper for retaining the reduced bones [i]. Even if a fracture ſhould unluckily accompany a diſlocation, the latter is always reduced before the fracture is touched; partly for the foregoing reaſons, and partly becauſe the reduced fragments might be diſplaced again by the force required to reduce the luxation [k]. But if the joint has continued diſlocated for ſome time, the parts affected ſoon ſwell, inflame, and become extremely painful; whence there might be danger of inducing a gangrene by a rough handling. Alſo the ligaments, which have been long diſtracted, loſe their ſtrength; whence the reduced joint may be very eaſily diſlocated again. And the conſiderable glands, which are ſeated in the larger articulations, being ſet free from the compreſſure by the head of the bone, or elſe inflamed, may ſwell ſo as greatly to diminiſh the cavity of the joint; whence the reduction will become difficult, and the retention ſtill more difficult. Add to this, that the mucilage or liniment lubricating the joint, and which uſed

[h] De Articulis, circa finem. Charter. Tom. XII. p. 466.
[i] De la Motte Traite Complet de Chirurgie, Tom. IV. p. 358.
[k] Ibid. p. 398.

ſed to be attenuated and diſperſed by its conſtant motion, will now be accumulated, and often reduced into ſo thick a maſs, that it can afterwards be diſſolved by no art, but fills up the cavity of the joint, ſo that there is no longer any room for receiving the head of the bone. If again it be conſidered, that an inflammation often follows unleſs the luxation is ſpeedily replaced, which may cauſe a deep ſuppuration, (as Hippocrates[1] obſerves in treating on a luxation of the thigh;) the reaſon will be very evident, why many bad conſequences may be foreſeen in the prognoſis, if the diſlocation continues any conſiderable time before its reduction is attempted.

A concretion.] It is well known, that all parts of the body contiguous to each other are prevented from growing together by the intervention of a thin vapour like dew, which repleniſhes all the larger and ſmaller cavities of the body. But when this dew is abſent, the parts which were before ſeparated ſoon grow to each other. Now when the parts are inflamed, the great diſtenſion of the larger veſſels compreſſes theſe ſmaller exhaling ones: whence follows that dryneſs of the parts in inflammations, which cauſes them readily to cohere and grow together. Thus the lungs are almoſt conſtantly found adhering to the pleura after a pleuriſy or peripneumony. Therefore the head of the bone now diſplaced, and deprived of its natural liniment, will readily cohere and grow to the adjacent parts, which are alſo at the ſame time inflamed by the violent diſtraction or compreſſion which they endure; from whence it is evident that the reduction muſt be then impracticable. But we have already ſeen, that the cavity of the joint likewiſe may be ſoon filled, by a luxuriancy of the glands, or an inſpiſſation of the mucilage. And perhaps too the boney cavity itſelf may ſhrink and grow gradually leſs from the abſence of the diſlocated head of the bone; for we ſee, that, after the evulſion of a tooth, the ſides of the jaw compoſing the alveoli do by degrees cloſe and meet together, till they are at length

[1] De Articulis. Charter. Tom. XII. p. 411.

length so united that no mark of the socket of the tooth remains.

Pain.] A recent luxation is always accompanied with pain, as we said before in the commentary on §. 364. But if this pain is extremely excruciating, the worst events may justly be feared; because it denotes that the aching parts are in such a state as tends to a total dissolution of their continuity, (see §. 220.) Also the worst consequences of extreme pain, enumerated in §. 266. may be thence expected; more especially as the reduction of the luxated bones requires a forcible extension of the parts already full of pain; whence there may be danger of convulsions, delirium, a gangrene, *&c.*

Inflammation.] How an inflammation comes to be a consequence of a luxation, has been explained in the commentary on §. 364. For it is almost a constant attendant, unless the dislocation was speedily reduced. Now, when a violent inflammation has invaded the dislocated part, there is the utmost danger. For unless the luxation is reduced at first, it will be very difficult to do it afterwards: and if the parts are roughly handled during the inflammation, a gangrene may follow in a little time. But in such a case, of two evils the least is to be chosen; and therefore it will be best to relinquish the reduction until the inflammation is removed or abated by proper remedies. This is also the opinion of Hippocrates, who, in treating of the most dangerous luxations, says, *That they are to be reduced the same day, or the day after; but by no means on the third or fourth day: For when they have been neglected until the fourth day, we have observed the worst symptoms to attend. If therefore they are not immediately reduced, those days are to be passed over in expectation; for it usually happens that they may be reduced within ten days* [m]. And in another place [n], speaking of a luxation of the cubitus, he lays it down as general rule, That it is not proper to

[m] Eodem die restituendæ sunt, vel sequenti; tertio vero aut quarto minime. Ubi enim usque ad quartum diem duraverint, maxime recrudescere videmus. Ubi ergo non protinus recondantur, his diebus supersedendum est. Contineri enim solet, quod intra decem dies conditur. *De Articulis. Charter. Tom. XII. p.* 445.

[n] De Fractuis. Charter. Tom. XII. p. 267.

o reduce any luxation while the fever continues, nd above all not to reduce that of the cubitus. A ever is both a ſign and attendant of a violent inflam- ation which accompanies a luxation. Thus alſo elſus adviſes, That whatever is diſlocated ought to be eplaced before the inflammation appears: but when at has invaded the parts, it ought not to be moleſted till is appeaſed; and when it is over, trial may be made hat can be done with the diſlocated limb [o]. In the ommentary on §. 364, we related a caſe, in which a ery bad gangrene followed the reduction of the cubi- us while the parts were in a ſtate of inflammation. In ich a caſe, therefore, the reduction ſhould be poſtpo- ed, and the patient or his friends acquainted with the anger that is threatened by ſuch an attempt; and that e cure may be difficult afterwards, and often not com- ete: and this to prevent any reflection on the phyſi- an or ſurgeon. For though a luxation ought to be duced as ſoon as poſſible, when nothing forbids; yet bſervations teach us, that we ought not wholly to de- air, tho' the joint has been a long time diſplaced. For luxation of the humerus, accompanied with a violent flammation, could not be reduced till after the expi- tion of two months time; but yet a complete cure as made of ſo inveterate a malady [p]. But what ob- nate ſymptoms follow the extenſion of a joint while is inflamed, is demonſtrated in ſeveral inſtances by ildanus [q].

Convulſion and other bad ſymptoms.] That a con- lſion ſometimes follows a luxation, was ſaid in the mmentary on §. 364; and this eſpecially from extreme in, and a violent extenſion or diſtortion of the ten- ns or muſcles. But of what conſequence a convul- n may be, we declared in the commentary on §. 233. ow, it is evident that no attempt can be made to re- ce a luxation during convulſions; becauſe the pain ould be then violently increaſed as well as the diſtrac- n of all the parts, and therefore the convulſive cauſes ould be thence increaſed. The ancient phyſicians were

[o] Celſus, lib viii. cap. 11. p. 544. [p] La Motte Traite Complet de rurg. Tom. IV. p. 354. [q] Centur. 2. obſ. 90. p. 168.

were so fearful of convulsions in these cases, that Hippocrates [r], and Celsus [s] after him, even says, That if a convulsion follows after the bone is reduced, it must be immediately displaced again. And Hippocrates in another place [t] seems for this reason to pronounce a luxation of the jaw fatal in those who are subject to cramps and to be convulsed backwards: for then this luxation cannot be reduced because of the cramp; and if it is not reduced, life is in danger, as was said in the commentary on §. 364.

If now a violent fever, faintings, hickups, *&c.* attend, over and above the symptoms now enumerated; it is evident, that to reduce a luxation cannot be safely attempted, and that therefore the prognosis must be hard.

The investing parts being thinner or thicker.] It was said before, from Hippocrates, in the commentary on §. 363, that fleshy joints do not so easily slip out, but then they are more difficult to replace when out. Therefore the luxations of those larger joints which are encompassed with large muscles, and confined by strong ligaments, are the most dangerous. For such joints cannot be dislocated but by the greatest violence; whence the most alarming symptoms often follow. Hence it is that Celsus, treating of those luxations which are accompanied with a wound, says, *But here the danger is great; and the more as the limb is larger, and confined by stronger ligaments and muscles. And therefore, in such luxations of the humerus or femur, the patient's life is in danger: insomuch that, if the bones are replaced there are no hopes; and if they are not replaced, there is also some danger* [u]. And in treating on a luxation of the thigh, he says, *But there is great danger in a luxation of the femur, because it is very difficult to reduce; and, when reduced, ready to be again displaced,* &c. *And as the tendons and muscles are here very strong, they scarce admit*

[r] De Articulis. Charter. Tom. XII. p. 445. [s] Lib. viii. cap. 2 p. 557. [t] Coac. Prænot. nº 361. Charter. Tom. VIII. p. 87

[u] Hic vero et ingens periculum est; et eo gravius, quo majus membrum est, quove validioribus nervis aut musculis continetur. Idcoqu ab humeris, femoribusque, metus mortis est; ac si reposita sunt os spes nulla est; non repositis tamen, nonnullum periculum est. *Lib.* vi *cap.* 25. p. 557.

admit of being replaced, provided they have their due ſtrength; and if they have not their due ſtrength, the reduced bones cannot well be retained in their ſituations [w]. From hence it is evident, that attention muſt be given to theſe particulars in forming a prognoſis.

A rupture or elongation of the ligaments.] If the confining ligaments of the joint have been ſo much ſtretched as to ſuffer the bone to ſlip out of its ſeat, they may be afterwards contracted and reſtored to their former ſtrength, provided they are not broken: but if they have been quite broken, there is great danger leſt the recent wounded lips ſhould grow to the bones or to the adjacent parts, or leſt the cicatrix of the late wound ſhould render the ligaments leſs flexible; whence the eaſy motion of the joint would be afterwards impeded. Thus, for example, a luxation of the os femoris can ſcarcely be ſuppoſed to ariſe ſuddenly from ſome external violence, (for that a luxation may ariſe from a gradual elongation and weakneſs of the ligaments from ſome cauſe ſeated in the cavity of the joint itſelf, is certain), without breaking the round ligament which ariſes out of the acetabulum. Hence the difficulty of cure in this caſe is evident: for it is very ſeldom that the contracted ends of the broken ligament grow together again; whence the reduced bone may be afterwards more eaſily diſplaced. But when the diſlocated bones appear through a wound of the integuments, the caſe is then very difficult, eſpecially if their ligaments are entirely divided, inſomuch that Hippocrates deſpairs of a cure in ſuch luxations: for he ſays, *But in thoſe luxations of the bones of the leg, in which the articulation is perfectly diſplaced, and accompanied with a wound near the foot, whether towards the internal or external ankle, theſe ought not to be reduced, but left to the care of the phyſician who attends; for it is to be obſerved, that the patient dies if the bones are replaced, or at moſt they ſurvive but a few days; for not many of them exceed the ſe-*

[w] Magnum autem femoris periculum eſt, ne vel difficulter reponatur, vel repoſitum rurſus excidat, &c. cum ibi valentiſſimi nervi muſculique ſint, ſi ſuum robur habent, vix admittere ut reponatur; ſi non habent, repoſitum non continere. *Ibid. cap.* 20. *p.* 455.

venth day, being taken off with convulsions [x]. He obſerves, that the only hope in theſe luxations is, when the bones of the joint are not replaced; for then the patient may be preſerved, though not without an unſightly lameneſs remaining during his life-time afterwards. He ſays likewiſe, that there is the ſame danger when the bones of the arm are diſlocated with a wound. He obſerves further, that theſe luxations are the worſt when they happen in the bones of ſtrong people: ſo that if the femur is diſlocated at the knee, a reduction of it will kill the patient ſooner than in other caſes; and if there is no reduction, the danger will be likewiſe greater than in other caſes [y]. He adviſes not to attempt the cure of luxations when they perforate the ſkin with a wound; excepting only in the fingers and toes: and even then not without great caution, becauſe the bones afterwards ſuppurate, whence the phyſician might gain diſcredit; and therefore he ought not to be over-forward in attempting to reduce thoſe luxations. But extraordinary events demonſtrate, that we ought not always to deſpair in theſe caſes; eſpecially if ſuch a luxation accompanied with a rupture of the ligaments, is in the lower joints. A very active woman jumped down on her feet from an high tree, which occaſioned a large ecchymoſis in the left leg from the toes to the middle of the thigh; but the right leg, pitching only upon the ankle, was ſo twiſted, that the os tibiæ ſtarted through the integuments to the length of three or four fingers breadth, and alſo ran into the earth; at the ſame time too the fibula was fractured at about the diſtance of two fingers breadth from the joint. The violent contuſion and laceration of the parts occaſioned the expert ſurgeons to conclude that the part muſt be amputated. But as the patient was in the flower of her age, of a ſtrong and healthy habit, and the

[x] Quibus autem cruris oſſibus luxatis, et vulnus facientibus, penitus excidunt articuli, qui circa pedem ſunt, ſive in interiorem, ſive in exteriorem partem, tales non ſunt reponendi. ſed ſinendum eſt, ut ille medicus, cui hoc placet, reponat. Scire enim licet, quod moriatur, ſi reponſiti ſerventur, et paucorum dierum vita fiet. Pauci enim ſeptimum diem excedunt. Convulſio enim occidit. *De Articulis, Charter. Tom. XII. p.* 435.

[y] Ibid. p. 444, 445, 446.

the diſorder ſeated towards the lower part of the limb, a reduction of the fractured and diſlocated bones was attempted: for there was a fair opportunity of waiting to ſee if there might be hopes of a cure; ſince the gangrene, which was here juſtly expected, very ſeldom comes on ſo faſt but that it may be afterwards ſucceſsfully extirpated. But beyond all expectation the pains were mitigated, and convulſions prevented by uſing the beſt remedies; ſo that by an exfoliation of the divided parts of the tibia and fibula which had been expoſed to the common air, this woman happily eſcaped from ſo dangerous a malady; inſomuch that ſhe could afterwards walk, and perform her wonted buſineſs, though with a ſtiffneſs remaining in the joint of the foot [z]. It is notwithſtanding ſufficiently evident how difficult and dangerous luxations are, in which the ligaments are deſtroyed.

The annexed muſcles.] For if very ſtrong muſcles are ſeated about the joint, it cannot be diſlocated but by the moſt violent cauſes; from whence the muſcles are often ſo much diſtracted, that they do not afterwards recover their priſtine ſtrength, or at leaſt they receive it but very ſlowly; and therefore there will always remain a deficiency in the motion of the diſlocated joint for the future. Thus, for inſtance, it is known from anatomy, that one of the tendons of the biceps muſcle of the arm ariſes from the upper and outward part of the ſinus in the ſcapula, into which the head of the os humeri is received; and paſſing through the ligamentary capſule, over the head of the bone, it proceeds to the ſinus or groove in that bone; and from thence emerging, it becomes a fleſhy belly, and unites with the other head of the ſame muſcle: If, now, the head of the humerus is diſlocated forwards, it is very evident that this tendon of the biceps muſcle will ſuffer a great diſtenſion, whence the motion of the joint will perhaps remain for the future in ſome meaſure diſturbed.

Having thus pointed out the principal ſources from whence the prognoſis of luxations may be deduced, it now remains for us to treat of their cure.

[z] De la Motte Traite Complet de Chirurgie. Tom. IV. p. 435, &c.

§. 367. IN order to which are required, 1. A reduction of the diſlocated bones; and, 2. A retention of the replaced bones in their proper ſituations, in order to complete the cure.

If every thing be duly conſidered, and it appears that there are no ſymptoms which can render a reduction of the bones either uſeleſs, inexpedient, or impoſſible, it muſt be then attempted. We obſerved before, that it was impracticable to reduce luxations which are of long ſtanding, becauſe generally the cavity of the joint is filled with concreted juices, or a luxuriancy of the parts freed from the preſſure of the diſlocated bone. We alſo obſerved, that a cure could not be attempted while the parts were invaded with inflammation, large tumour, or convulſions; nor when it is perceived that theſe ſymptoms will ſoon after follow: for then prudence requires to defer the cure; in order to which, the two following particulars are neceſſary.

1. This is ſelf-evident.

2. The ligaments which connect the bones to each other, give the joints their chief ſtrength. Now no luxation can happen, without theſe ligaments are either broken, or ſo much elongated that they ſuffer the head of the bone to be diſplaced. But it was ſaid before, in the commentary on §. 363, that a violent diſtenſion may ſo weaken the ſolid parts of the body, as to make them loſe much of their ſtrength: ſo that tho' the bones are replaced; yet the ligaments, not immediately regaining their former ſtrength, eaſily permit the joint to be diſlocated again, unleſs prevented by art. And how eaſily a joint may be again diſlocated after a reduction has been made, we are taught by the caſe related by the ſurgeon whom we have ſo often recommended. For he[a] ingenuouſly confeſſes, that he could neither prevent the elevation of the patient's arm, nor the diſlocation of the bone the ſecond time, when he attempted to reduce the luxated humerus; and yet he reduced the bone again ſo ſpeedily, that neither the patient, nor the ſervants who aſſiſted him, could perceive

[a] Ibid. p. 347.

ceive his error. The cure of a luxation therefore requires a retention of the reduced bones in their proper ſituations, until the ligaments have recovered their due ſtrength, ſo as to be able to perform their uſual motions without danger of being diſlocated again; for this is the main end of the cure. But the time required for the ligaments to recover their former ſtrength again, is not very exactly limited by authors: it is, however, certain, that more or leſs time is required according to the different magnitude of the luxation and of the joint, the different temperature of the patient, and the more or leſs urgency of the attending ſymptoms. The magnitude of the luxation is meaſured by the diſtance of the diſplaced bone from its cavity, as we obſerved before under the preceding aphoriſm; and it is very evident, that the ligaments muſt ſuffer a greater violence, in proportion as the head of the bone is farther diſplaced from its natural cavity: whence a longer time will be neceſſary to complete the cure. Add to this, that the greater or leſs weight which the limb is to ſuſtain when in health, will alſo more or leſs protract the cure: thus a luxation of the femur and ankle, requires a long time of reſt, as Celſus [b] obſerves; but the joints of the fingers recover their ſtrength in four days time, as Hippocrates [c] tells us. But what a difference, in this reſpect, is made by the different conſtitution of the patient, Celſus again informs us, when he ſays, *If the body is thin and moiſt, and the ligaments are weak, the bone is more ſpeedily reduced; but then it more eaſily ſlips out again, and cannot be ſo ſecurely retained: Whereas in thoſe patients who are of a contrary diſpoſition, the bones are more ſecurely retained, but more difficultly reduced* [d]. The like we alſo meet with in Hippocrates [e]. It is evident enough, that the number and violence of the ſymptoms often prolong the cure: but yet Hippocrates obſerves, that a ſlight inflammation following the

[b] Lib. viii. cap. 20, & 22. p. 555, 556.

[c] De Articulis, in fine. Charter. Tom. XII. p. 467.

[d] Si corpus tenue, ſi humidum eſt, ſi nervi infirmi, expeditius os reponitur; ſed et multo facilius excidit, et minus fideliter continetur. Quæ contraria his ſunt, melius continent: ſed id, quod expulſum eſt, difficulter admittunt. *Lib.* viii. *cap.* 11. *p.* 544.

[e] De Articulis, texu 27, 28. Charter. Tom. XII. p. 306, 307.

the reduction, is rather ſerviceable than prejudicial; ſince the pain then prevents the uſe of the limb, and the ligaments being kept in a ſtate of tenſion by the inflammation retain the bone more ſecurely in its cavity. Thus he ſays, in the place before cited, which we likewiſe mentioned upon another occaſion §. 224, nº 3.: *Thoſe who have the joint reduced, without any inflammation of the circumjacent parts, are capable of uſing their arm immediately without pain, and think that they have no occaſion for any farther aſſiſtance: but it is the buſineſs of the phyſician to declare againſt their opinion, in as much as they will be more liable to a ſecond diſlocation than thoſe whoſe ligaments are inflamed* [f]. It can never be hurtful to ſecure the parts of the diſlocated limb, ſo that it may not be moved for a conſiderable time, provided that care is alſo taken not to let the joint grow ſtiff by too long a reſt.

At the ſame time alſo, in the cure, the moſt troubleſome ſymptoms muſt be relieved by a proper diet, and ſuitable remedies; which may likewiſe prevent future ſymptoms, the chief of which are pain, inflammation, and all the bad conſequences that may from thence follow. But of theſe we treated before, and ſhall in part conſider them hereafter. But it is very apparent, that the more numerous and grievous ſymptoms are to be expected, as the diſlocated limb is larger; ſince ſuch a limb cannot be diſlocated but by the moſt violent cauſes, and will alſo require an extenſion proportionably ſtrong to make the reduction. Hence Hippocrates [g] obſerves, that, in the reduction of all joints, the patient muſt be enjoined ſtrict abſtinence, eſpecially where the articulation is very large, and the reduction difficult; but that abſtinence is leſs neceſſary when the articulation is ſmall, and eaſily replaced.

§. 368. THE reduction is performed, 1. By holding the patient's body firm; 2. By

f Qui repoſito articulo, partibus ambientibus nulla inflammatione affectis, protinus humero uti ſine dolore poſſunt, hi nulla cura ſibi opus eſſe arbitrantur. Sed medici officium eſt præſagire contra illorum opinionem, ſi quidem his rurſus prolabitur magis, quam quorum nervi inflammatione tentantur. *Ibid. textu* 29. *p.* 308.

g Ibid. p. 466.

By moving the limb ſo, that the bone may directly correſpond to its cavity; 3. By introducing it into the cavity by puſhing, turning, and ſtriking it.

1. As more or leſs extenſion is required to reduce a luxation, it is evident that it cannot be performed without pain, for the reaſons before mentioned, §. 349, n° 2. It is therefore neceſſary ſo to ſecure the patient, that he may not diſturb the operator; and it is likewiſe neceſſary to prevent his whole body from moving, when the affected part is extended.

2. Galen [a] prudently adviſes, in treating of the cure of luxations in general, that it is neceſſary to replace or return the diſlocated bone the ſame way in which it was diſplaced. Therefore, in every luxation, it will be neceſſary to conſider the place whence the joint has gone out, the way it has taken, and its preſent ſituation; in order that the bone may be gradually returned, by the ſame direction, from its preſent ſite to the point of diſlocation: And then he illuſtrates the aſſertion by an inſtance of the humerus being diſlocated forward. But how uſeful this admonition will be towards a happy reduction of diſlocated bones, is ſufficiently evident; for the bone which has receded from its natural place, makes itſelf a way by removing the adjacent parts; and may therefore more eaſily return by the way which it has already made, than by any other: and this more eſpecially, if the bone is diſplaced by the breaking of the ligaments of the articulation; for in that caſe, if the bone is not directly moved to the ſame part, it cannot return into its natural ſituation. In order to perform this, an extenſion is neceſſary to be made more or leſs ſtrong in proportion as the diſlocated joint is ſmaller or larger; which extenſion is alſo neceſſary in order to prevent any of the adjacent parts from being intercepted while the head of the bone is reducing to its proper ſeat. A ſufficient extenſion may be generally made by the hands, in luxations of the ſmaller joints; or, in young and lax habits of body, even the ſame method may be ſufficient for the larger joints; but if a ſtronger

[a] Comment. 1. in Hippoc. de Artic. Charter. Tom. XII. p. 294.

ſtronger force is required, it will be often neceſſary to make uſe of ſlings and machines. A great many beautiful obſervations are to be found in Hippocrates's book *De articulis*, concerning theſe machines, to which the moderns have added others; ſee alſo what has been ſaid of them in the commentaries on §. 349.

3. When the diſlocated limb is once properly extended and directed, ſo as to correſpond to its cavity, the remainder is then eaſily performed. Whence Hippocrates, treating of a luxation of the femur inwards, ſays: *If the femur is rightly extended, its head will be drawn directly over-againſt its priſtine or natural ſeat, and in this diſpoſition it will not be eaſy to prevent it from ſlipping directly into its proper cavity or ſeat, to do which almoſt any thruſt or direction will then ſuffice: But if the aſſiſtants are defective in their extenſion, the reduction will be on that account the more difficult* [b]. For the elaſticity of the ligaments and ſtrength of the muſcles are frequently in that caſe ſufficient to return the diſlocated bone into its proper ſituation. But a knowledge of the ſtructure of the diſlocated joint will readily acquaint a ſkilful ſurgeon what is further neceſſary to be done, if the bone does not ſlip into its ſeat, after it has been reduced near to its cavity by a due extenſion; for then a gentle twiſting, a ſtroke, or a thruſt will be frequently ſufficient to replace the bone. Nay, in many caſes, an experienced operator will effect both the extenſion and reduction almoſt in the ſame inſtant of time. Thus Celſus, in treating on the reduction of the lower jaw, ſays, after having obſerved in what manner the patient ought to be placed and ſecured: *When the jaw, being diſlocated on one ſide, is taken hold of firmly, the chin is to be ſtruck with a blow, and directed back towards the throat: at the ſame time alſo the head is to be held faſt; and, by agitating the chin, the lower jaw is to be forced into its ſeat, preſſing upon that bone in ſuch a manner as to perform almoſt the whole operation*

[b] Si bene extenſum fuerit, femoris caput e regione priſtinæ ſuæ ſedis attolletur; cumque ſic ſublatum fuerit, non facile prohiberi poterit, quominus in ſuam ſedem revertatur; ſic ut quævis impulſio et directio ſufficiat. Sed deficiunt in extenſione, idcirco majorem moleſtiam habet repoſitio. *De Articulis. Charter. Tom. XII p. 456.*

ration in a minute [c]. When ſurgeons endeavour to reduce a luxation of the humerus, by ſuſpending the patient with his arm over a door, a ladder, *&c.* making a violent extenſion, the arm hanging downwards, the diſlocated joint then frequently returns to its ſituation in a moment. But how much it is for the ſurgeon's intereſt and ſucceſs in the cure, to be aſſiſted with ſkilful hands, eſpecially in difficult caſes, is ſufficiently apparent.

That the diſlocated bone is returned into its former ſituation, is generally perceived by the ſound or noiſe which it makes in the moment of its reduction: but Celſus obſerves, That the head of the humerus may be puſhed into its ſeat, as well without a noiſe as with [d]. Almoſt all ſurgeons have obſerved, however, that there is conſtantly at leaſt ſomething of an obſcure noiſe to be heard at the time of the reduction. Fabricius ab Aquapendente [e] ſeems to have been much alarmed with danger from this noiſe, imagining it to proceed from the colliſion of the head of the bone againſt the edge of its cavity, whence this laſt might be broken before the head of the bone could enter it; and therefore he thought a complete reduction to be impracticable: he likewiſe judged the noiſe to ariſe ſometimes from the percuſſion of the head of the bone againſt its cavity or ſocket, from whence the worſt ſymptoms might be afterwards feared. But daily experience, and the obſervations of the moſt faithful ſurgeons, ſufficiently convince us, that this fear is without any foundation, ſince the noiſe is generally perceptible, and that without being followed by any of the bad conſequences which might be juſtly expected from thoſe cauſes. It was ſaid before, in the commentary on §. 365, that a diſtortion or alteration in the figure of the limb, is to be reckoned among the principal diagnoſtic ſigns of a luxation, if joined with the tumour

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[c] Ubi vehementer maxilla apprehenſa eſt, ſi una parte procidit, concutiendum mentum, et ad guttur adducendum eſt: tunc ſimul et caput adprehendendum, et, excitato mento, maxilla in ſuam ſedem compellenda, et os ejus comprimendum eſt, ſic ut omnia pene uno momento fiant. *Lib.* viii. *cap.* 12. *p.* 546.

[d] Ibid. cap. 15. p. 549. [e] Chirurg. Univerſ. lib. v. cap. 1. p. 353.

in ſome other part. When the diſlocated bones are properly reduced, it is evident that all theſe muſt again diſappear. It is likewiſe obſervable, that pain always accompanies a recent luxation from the violent diſtraction of the ligaments and other adjacent parts; but ſo ſoon as the joint is reduced, that pain immediately ceaſes, or at leaſt is much diminiſhed: for ſometimes a ſmall degree of pain may continue from the violent extenſion, which the circumjacent parts and ligaments of the bones have ſuffered in the reduction, though ever ſo well made; ſince alſo a very ſtrong extenſion is often required, before the reduction can be made.

§. 369. AFTER the bones are reduced to their proper ſituations, they are to be retained there by reſt, bandages, and a natural diſpoſition or poſture of the parts.

After the bones have been reduced to their proper ſituations from whence they were diſplaced, then the other part of the cure (§. 367, n° 2.) ſtill remains; namely, to retain them in that ſituation. And this is performed

By reſt.] In every diſlocation the confining ligaments of the joint have been either broken, or very much elongated; ſo that if reſt is not ordered, the replaced bone may eaſily ſlip out again. It was demonſtrated before, in §. 25, n° 3. that the ſolid parts of the body may be weakened by too great a diſtraction; and in §. 28, n° 5. it was affirmed, that the ſtrength or coheſion of the ſolids is increaſed by the long continuance of all the parts in the ſame contact, which is ſometimes carried ſo far that they at length acquire too much ſtrength or ſtiffneſs: Reſt will be therefore always neceſſary, to reſtore the ſtrength of the over-ſtrained ligaments, or to procure an union of them if they are broken. But care muſt be taken not to let the ligaments become rigid by too long a reſt; nor to give occaſion for an anchyloſis to be formed by an accumulation of the mucilage of the joint, which may become inſpiſſated for want of motion. Hence it is adviſeable

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to gently move and rub the joint for ſome days after it has been diſlocated, provided all the pains are abated, and there is no danger of an inflammation, as Hippocrates [a] carefully obſerves, in treating of the cure of a luxation in the humerus. But Celſus remarks, that this caution ought more eſpecially to be obſerved in a diſlocation of the elbow, when he ſays, *The dreſſings are to be ſpeedily and often removed; and the part is to be well fomented with warm water, and to be rubbed for a conſiderable time with oil, ſalt, and nitre. For a callus is ſooner formed in the cubitus than in any other joint, whether it remains diſplaced, or reduced to its proper ſituation; and if it ſhould by reſt concrete, the flexibility of the joint will be afterwards deſtroyed* [b]. Beſides this, the pain or inflammation, which often continues from the violence offered to the injured parts, alſo requires the limb to be kept at reſt for ſome time after the reduction.

By bandages.] Unleſs the ligaments are quite broken, or violently ſtretched, the reduced bone may be eaſily retained in its ſituation, barely by keeping the part at reſt: ſo that bandages are not always neceſſary. Agreeable to this, we are told by a very ſkilful ſurgeon [c], that he applied no bandages after a reduction of the lower jaw, and yet the cure ſucceeded very well. But if there is any danger of a relapſe in the diſlocated joint, it may be beſt to ſecure the part with bandages; eſpecially if the preſſure of the compreſſes and other dreſſings is determined by the bandages moſtly to the affected part from whence the bone was diſplaced. This has been very well obſerved by Hippocrates, in treating of a luxation of the humerus, where he ſays, *Theſe luxations ought therefore to be ſecured by plaiſters, compreſſes, and the application of many bandages: but in the axilla is to be fixed a piece of woollen-cloth rolled up, ſufficient to fill the cavity of the armpit, in order to ſuſtain*

[a] De Articulis, textu 30, 31. Charter. Tom. XII. p. 308.

[b] Celerius tantum ſæpiuſque id reſolvendum eſt, multoque magis aqua calida fovendum, et diutius ex oleo et nitro ac ſale perfricandum. In cubito enim celerius, quam in ullo alio articulo, ſive extra remanſit, ſive intus revertit, callus circumdatur; iſque, ſi per quietem increvit, flexus illius poſtea prohibit. *Lib.* viii. *cap.* 16. *p.* 551.

[c] De la Motte Traite Complet de Chirurgie, Tom. IV. p. 335.

the joint and fill out the bandage [d]. For by this means the head of the bone may be prevented from ſlipping out again from its ſeat into the cavity of the axilla; which, Hippocrates [e] ſays, is the only manner in which the humerus can be luxated, as far as he could ever obſerve; and therefore he has not treated of the other ſpecies of this luxation.

But it is very evident, that by knowing which way the bone has been diſplaced from its cavity, it may be prevented from ſlipping out again by the application of a bandage ſuitable to each particular luxation. But when the part has been thus ſecured by bandage, it ſhould be ſeldom opened, unleſs an inflammation ſhould attend; for then the apparatus of dreſſings are to be more frequently removed in all luxations, according to the direction of Hippocrates [f].

The natural poſture of the part.] It is evident the part affected muſt be kept at reſt a conſiderable time. But that it may be ſo retained without uneaſineſs, it will be neceſſary to place it in the ſame poſture in which we obſerve the limbs when a perſon is ſleeping, and when none of the muſcles are acting by the influence of the will: but at that time the flexor muſcles of the limb do by their contraction prevail over the extenſor muſcles; from whence it is that we obſerve almoſt all the joints a little inflected. See what has been ſaid concerning the natural ſituation of the parts in the commentary on §. 349, n° 3. Therefore Hippocrates lays it down as a general rule in every luxation, That it will be always proper to keep the lame joint at reſt, and in the moſt convenient poſture [g]. And hence he deſcribes the particular poſture moſt convenient for each luxation. Thus, for example, in treating of a luxation of the cubitus, he ſays [h], that the part ought to be ſo diſpoſed in the cure, that the extremity of the hand may be a little higher than the cubitus, while the arm is placed by the ſide of the body: for by that means it may be

[d] His ergo mederi oportet cerato et ſpleniis, et multas faſcias circumdare: ſupponere autem axillæ lanam molem puram convolutam, quæ cavum (axillæ) repleat, ut vinculum fulciat, et articulum ſuſtineat. *De Articulis, textu* 29. *Charter. Tom. XII. p.* 308. [e] Ibid. textu 3. p. 290. [f] Ibid. p. 466, 467. in fine libri. [g] Ibid. textu 29. p. 467. [h] Ibid. p. 331.

be ſuſpended and carried without any uneaſineſs; and it will be likewiſe more commodious for uſe, and agreeable to nature.

All theſe particulars being duly obſerved, we may reaſonably expect a happy cure, when the bone has been diſlocated by ſome external violence. But when the bone has ſlipped out of its cavity from a relaxation of its ligaments, the cure then will be much more difficult; whence Celſus pronounces, That thoſe joints, which are diſlocated through a defect in their ligaments, ſlip out again, even after they have been reduced to their proper ſituations [i]. The reduction of theſe luxations is indeed very eaſy; but the retention of them is very difficult, and even ſometimes quite impracticable. All the hope, in this caſe, depends upon a long continued reſt of the part, with the application of ſtrengthening fomentations, which may reſtore the relaxed ligaments to their due firmneſs. Petit [k] has obſerved happy ſucceſs in theſe caſes from the application of thick compreſſes dipt in aromatized ſpirit of wine, and ſpread with a mixture of powdered allum with the white of an egg, ſecured all round the articulation of the femur by a convenient bandage; and he frequently applied the ſame medicine to moiſten the bandages and compreſſes, without removing the apparatus. Galen tells us [l], that he twice cured a luxation of the femur proceeding from a relaxation of the ligaments; but affirms, that the articulation ought to be inveſted for a conſiderable time with drying medicines, in order to remove the redundant humidity of the ligaments. Even Hippocrates acknowledges ſo much difficulty in the cure of theſe luxations, that he has recourſe to the laſt refuge of the art, namely to fire or cauterization. For he obſerved that many were by this accident rendered incapable of war and other exerciſes, nor did he ever know any one who rightly treated them, and therefore he is the more large in his deſcription of this method of cure. But he ſpeaks principally of that ſpecies of

i Celſus, lib. viii. cap. 11. p. 544. k Acad. des Sciences, l'an 1722. Mem. p. 163. l Comment. iv. in Hippocrat. de Artic. Charter. Tom. XII. p. 453.

luxation in which the head of the humerus slips into the axilla; though it is also very evident, that the same method of cure is likewise applicable to other luxations, both of the same and of other joints.

The whole design of the cure seems to consist in forming a cicatrix by the actual cautery in the skin and panniculus adiposus, whence the integuments are so much hardened as not easily to admit of being extended, whereby the bone will be prevented from slipping out again the same way. He orders the arm to be a little elevated, (for if it is not raised, one cannot have free access to the axilla; and if it is raised too much, the skin will be drawn so tight that it cannot be conveniently taken hold of); and the loose skin with the panniculus adiposus to be pulled out by the fingers, so that the integuments may recede a good way from the glands, large nerves, and considerable blood-vessels, which are there seated. He then orders the elevated skin to be very speedily perforated with an actual cautery which is not thick, but rather long and round; and he would have the iron to be so far heated as to be white or pellucid (χρη δε διαφανεσι καιειν): then the skin, being as yet elevated, is to have a slender spatula (υπαλειπτρον) passed through the two apertures made by the cautery; which being done, the skin is to be let loose, and another perforation made by a slender cautery forced through the integuments till it meets with the subjacent spatula. Thus the part may be cauterized in three distinct places without danger of injuring the subjacent parts. Now, during the time of the cure, the eschars will be separated; and then the integuments will unite or grow to each other, but in such a manner that they will be rough and hard with the scars occasioned by the loss of substance made by the cauteries: and therefore he advises not to raise the arm much during the whole time of the cure, but only to elevate it so much as will be necessary for dressing the wounds; for thus the integuments not being distended will give an opportunity for the lips of the wounds to cohere and unite with each other the more firmly and strictly. Even after the cure of the wounds, Hippocrates would have the arm tied down

down to the ſide for a conſiderable time, that the cicatrices may be rendered more firm and ſecure, and that ſpace contracted where the humerus uſed to prolapſe. He has alſo pointed out two other places where cauterization may be ſerviceable in this caſe; to wit, on each ſide the head of the os humeri, betwixt the bone and the large tendons which form the cavity of the axilla on each ſide, namely, the tendons of the pectoral muſcle and latiſſimus dorſi [m].

In like manner I remember the cure of ruptures was attempted formerly by a certain empiric, who, after returning the prolapſed inteſtines, deeply cauterized the integuments of the rupture, either with the actual or potential cautery; and this with a view, that they, being contracted with a deep cicatrix, might not ſo eaſily yield afterwards to any extenſion.

Of INFLAMMATION.

§. 370. AN INFLAMMATION, which is ſometimes called a *phlegmon* or *fire*, is ſo denominated from the ſimilitude both of its cauſes and effects to thoſe of fire.

Before we proceed to treat of Acute Diſeaſes, it is beſt to premiſe the hiſtory of Inflammation, with all its conſequences; becauſe that will afford much light into the nature of thoſe diſeaſes, and the ſucceſſive changes made by an inflammation in the external parts of the body towards health or another diſeaſe may be more diſtinctly underſtood; and from thence one may foreſee what will follow when the like diſorder invades the internal parts of the body.

General cuſtom has in all languages (as far as I can find) impoſed a name to this diſorder from that of fire. Thus it is termed *inflammatio* by the Latins, and *phlegmon* or *phlogoſis* by the Greeks. Nor need we wonder

[m] Hippocrat. de Articulis, textu 41, &c. Charter. Tom. XII. p. 312—320.

at this, since the greater heat, which was ever ascribed by all people to an inflammation, is proved from physics to arise from a greater quantity of fire. Thus Galen: *But this tumour, assuming a pulsation and fiery heat, answers then properly to the ancient title of* phlegmon. *But the ancients do not thus distinguish it; for they called any heat or inflammation a phlegmon, as I have frequently demonstrated. But from the time of Erasistratus it has been customary to term those tumours* phlegmons, *in which there is not only an inflammatory heat, but also a resistance and pulsation; they have also of necessity a redness so called*[a], &c. And in like manner he in another place[b] mentions heat among the diagnostic signs of a phlegmon. And thus Ægineta says, That indeed it was usual to call all hot tumours, accompanied with pain and burning heat, by the name of *phlegmons:* But that even these are said to differ according to their efficient matter: for good blood, of a moderate consistence, flowing plentifully and forcibly into any part, being there impacted by its quantity, occasions the *phlegmon* properly so called; but yellow bile lodging in any part forms an *herpes;* and blood flowing together with yellow bile causes an *erysipelas:* but when the influent blood is very hot and thick, it usually produces carbuncles[c].

Heat was therefore a common sign of every inflammation among the ancients, who gave the common appellation of *phlegmon* to all kinds of inflammation: but they afterwards restrained it to that species of inflammation, in which there was a resisting tumour, accompanied with a redness, and a burning heat; but to the other species of inflammation they gave different names. Thus in Celsus we read, That the signs of

[a] Hic vero tumor, assumens pulsum et igneum ardorem, antea proprie vocatam phlegmonen perficit. Non autem sic veteres; sed quemcunque ardorem vocabant phlegmonen, uti sæpius vobis demonstratum fuit. Verum ab Erasistrati temporibus solitum fuit, phlegmones nomen dici de illis tumoribus, in quibus non tantum est calor inflammans, sed et renixus et pulsus: ex necessitate vero habent et sic vocatum ruborem, &c. *Comment.* iii. *in lib. Hippocrat. de Fracturis. Charter. Tom. XII. p.* 236.

[b] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. p. 313.

[c] Ægineta, lib. iv. cap. 17. p. 63. versa.

of inflammation are four; to wit, a redneſs, and tumour, with heat, and pain [d]. Whence it appears, that the general name of *Inflammation* was, even among the Latins, reſtrained to only one particular ſpecies.

But that there is a greater quantity of fire in the inflamed part, is demonſtrated by thermometers, and the effects being quite ſimilar to thoſe which ariſe from the application of elemental fire to the body. For when a healthy perſon applies the back of his hand to a fire, he begins to perceive a greater heat; then the part will become red; and if he applies it ſtill nearer to the fire, it will ſwell and become painful: but if he continues to approach with his hand ſtill nearer to the fire, the pain will be violently increaſed, the cuticle will be raiſed into bliſters, and at length the ſkin itſelf will be burnt up into an eſchar by the increaſed action of the fire; which eſchar being abſolutely a dead or foreign ſubſtance, muſt be ſeparated from the living parts by a ſuppuration. Now the ill conſequences of an inflammation are altogether the ſame with theſe, and ariſe in the like order. For a ſlight heat, redneſs, and tumour, attended with pain, form an inflammation on the back of the hand; all which ſymptoms increaſe in proportion to the diſorder itſelf. But from a violent inflammation tending to a gangrene, the cuticle is alſo raiſed into bliſters; and gangrenous eſchars are formed, which muſt be likewiſe ſeparated from the living parts by ſuppuration: and if the inflammation ſtill continues increaſing in violence, all the parts appear black even to the bone, in the ſame manner as if they were burnt by the fire; and then the part is ſaid to be mortified or ſphacelated. Hence alſo Hippocrates calls an ardent fever by the name of fire, (τὸ πυρ); becauſe in that diſorder there is often ſo great a heat felt in the vital organs as if there was a real fire; from whence death often enſues very ſuddenly, And in the moſt ardent of fevers, the plague, when the malignity of the diſtemper is tranſlated to ſome particular part of the body, it is obſerved to be burnt up in ſuch a manner as if it was actually occaſioned by fire; as is evident

[d] Celſus, lib. iii. cap. 10. p. 139.

dent in the peſtilential carbuncles, which are afterwards ſeparated and thrown off by a ſuppuration all round them; and this perfectly in the ſame manner as is uſual when any part of the body has been burnt by a red-hot iron. Thus the wiſe ancients did, by obſervation only of the effects of an inflammation, denominate it juſtly from fire; ſince both the cauſes and effects of each are alike: and the modern obſervations concerning the nature of fire are a ſtrong confirmation of all that has been here ſaid.

§. 371. AND it conſiſts in a greater preſſure and attrition of the red arterial blood, ſtagnating in the ſmalleſt veſſels, and urged by the motion of the reſt of the blood, which is more forcibly agitated by a fever.

In this aphoriſm we are furniſhed with a definition of an Inflammation, or Phlegmon, properly ſo called from its cauſes, and denominated ſo by the ancients from its ſymptoms. For they defined a phlegmon, (as is evident from what we lately cited from Galen under the preceding aphoriſm), that it is a preternatural tumour, hard and reſiſting, with redneſs, heat, and a pricking pain, accompanied generally with a fever. But it muſt be obſerved, that the definition here given relates only to the inflammation ſo far as it extends to thoſe veſſels which naturally contain red blood, or which at leaſt may by dilatation admit the blood. But as for what relates to this diſorder, when it is ſeated in the moſt ſlender or lymphatic veſſels, we ſhall treat hereafter at §. 379, 380. This being premiſed, we may be able to explain the definition above given.

In this diſorder there are two concurring cauſes, which together conſtitute the nature or exiſtence of Inflammation; namely, obſtruction, with an increaſed velocity of the blood flowing into the obſtructed veſſels. For the blood ſtagnates in an inflammation; and cannot paſs through the ſmalleſt veſſels, even though it be urged forward by the impulſe of the ſucceeding blood: there

there is therefore an obſtruction of the veſſels denying a paſſage to the humours which they ought to tranſmit. But it is evident from what has been ſaid on §. 107, that an obſtruction is formed whenever this paſſage or tranſmiſſion of the humours through the veſſels is cut off. The obſtructing matter is the red blood of the arteries; becauſe it is in the arteries only that an obſtruction, properly ſpeaking, can take place, as we demonſtrated in the commentary on §. 119. And the parts of the veſſels obſtructed are their ſmalleſt branches and extremities; ſince it is evident, that the obſtructing particles may be as yet able to paſs through the larger veſſels, but will be ſtopped towards the ends of the ſmaller converging veſſels. But we do not here underſtand the ſmalleſt veſſels of all in the body, but only the ſmalleſt branches of the largeſt; thoſe, namely, which contain the groſſeſt part of the humours, the red blood. So that theſe veſſels may be called the ſmalleſt with reſpect to the largeſt of their own genus: but, with reſpect to thoſe which are ſtill ſmaller, even theſe may be termed large; for the ultimate ends of the ſanguiferous arteries will be always larger than the ſerous artery which thence ariſes, and which by the ſmallneſs of its diameter naturally excludes all the red blood. Thus it alſo is in the laſt extremities of the ſerous arteries, which will for the ſame reaſon be always larger than the lymphatic artery thence ariſing, *&c.* Hence it is evident, that a true phlegmon is almoſt conſtantly ſeated in the ſmalleſt ſanguiferous arteries, or elſe in the ſerous arteries dilated; and therefore this is the inflammation of the firſt order, as we termed it at §. 122. But when the obſtructing particles ſtagnate at the ends of the ſmaller veſſels, they will be neceſſarily compreſſed by the action of the vital humours behind; and this even with no ſmall force, ſince it is by the force of the heart and arteries that the blood flows into the obſtructed part with ſuch a velocity or impetus, as would be ſufficient to convey it through the extreme parts of the body, with a conſiderable degree of its velocity ſtill remaining; whence the preſſure muſt be great, and renewed at every contraction of the heart and arteries,

ries. (See the commentary on §. 120.) But as the obſtructing particles ſeem to remain immoveable, wedged into the extremities of the ſmaller veſſels, it does not ſo readily appear from whence the attrition muſt ariſe which ſeems to ſuppoſe the influx and return of theſe particles. But if what has been ſaid in the commentary on §. 132, n° 1. be duly conſidered, the obſtructing particles will appear to be not always immoveable or at reſt, but ſometimes repelled by the contraction of the arteries towards their larger diameter, and then again propelled forward by the force of the heart filling the arteries and urging the blood into their ſmalleſt extremities; and from hence it is that a real attrition is here produced.

All that has been hitherto ſaid is alſo applicable to obſtructions in the ſmalleſt veſſels formed by a ſtagnation of the red arterial blood; and therefore it is added in the definition, *More forcibly agitated by a fever*. When a violent inflammation has invaded any of the viſcera or more conſiderable parts of the body, we then always find it accompanied with a fever: but if the inflammation is ſeated in the ſmaller parts of the body, eſpecially the external, it may be then queſtioned whether a fever is always preſent; for an inflammation of the eyes, an inflammatory quinſy, *&c.* are frequently obſerved without any ſenſible alteration in the pulſe. This is very well explained by Galen, where he deſcribes the nature of pulſes which accompany inflammation: *For at the beginning of the inflammation the pulſe is larger, ſtronger, ſwifter, and more frequent than according to nature: but when the inflammation is increaſed, the pulſe is alſo increaſed in theſe reſpects, and becomes manifeſtly harder* [a], &c. And a little afterwards he adds, *This inflammation has ſomething in it which changes the pulſe throughout the whole body, either from the magnitude of it, or the importance of the part in which the inflammation is ſeated: but if the whole body is not affected, the pulſe*

[a] Incipiente enim inflammatione, pulſus major eſt quam ſecundum naturam, et vehementior, et celerior, et crebrior. Aucta inflammatione, omnia hæc increſcunt, et manifeſte durior ſit, &c. *De Pulſibus, ad Tyrones, cap.* 12. *Charter. Tom. VIII. p.* 8, 9.

pulse will be found thus (as we before described it) in the inflamed part itself [b]. It is therefore under this restriction that we are to understand the assertion that a fever is a general concomitant in every inflammation, at least in the inflamed part, if not in the whole body; since the strength and quickness of the pulse will be there increased, so as to occasion as it were a fever of the part itself, as Galen very well observes in another place. For after saying that there are a great many different sorts of inflammations, he observes, that a fever usually accompanies all of them. He then places the principal difference of inflammations in their being dry or moist: *The moist inflammation is indeed that which is formed by a hot defluxion invading the part: but the dry inflammation happens when the heat endeavours to inflame without any defluxion; and this is in a manner a fever of the part itself* [c]. It is also a firm opinion of the ancient physicians, that an inflammation is always accompanied with an increased motion: For Celsus in his preface, where he relates the different sects and opinions of physicians, has the following passage: *If blood is forced into those vessels, which are destined for lymph or spirits, it occasions that inflammation which the Greeks call a phlegmon; which inflammation has the same motion as in a fever, according to the opinion of Erasistratus* [d]. Here we are to observe, that he does not say simply that a fever arises whenever there is an inflammation, but only that there is the same motion attending an inflammation as attends a fever.

Hence we have a very salutary admonition proposed in the practice of physic by Dr Simson [e], that the physician

[b] Hæc inflammatio habet, quæ pulsum per totum corpus immutat, sive ob magnitudinem, sive ob principem partem, in qua consistit. Si vero universum corpus non afficiat, pulsus in parte inflammata talis erit, qualem diximus. *Ibid.*

[c] Humida quidem, quæ ex calida fluxione partem obsidente fit: sicca autem, quando sine ulla fluxione connatum calorem accendi contingit. Hoc autem quodammodo velut febris partis ipsius est. *De Meth. Med. ad Glaucon. lib.* ii. *cap.* 1. *Charter. Tom. X. p.* 367.

[d] Si sanguis in eas venas, quæ spiritui accommodatæ sunt, transfunditur, et inflammationem, quam Græci φλεγμονην nominant, excitat, eaque inflammatio talem motum efficit, qualis in fibre est, ut Erasistrato placuit. *Celsi Præfat. p.* 5.

[e] The System of the Womb, &c. by Thomas Simson, p. 106, 107.

ſician may not be deceived by imagining there is no inflammation when there is no fever. For there are often fixed pains which cauſe an inflammation of the ſtomach and inteſtines, even when no fever can be obſerved by an examination of the pulſe: and he ever afferts, that he has ſeen baſtard pleuriſies epidemical, which would have afflicted the patient for ſeveral months without a fever, unleſs they had been treated immediately with bleeding and other remedies proper to abate inflammation.

From what has been ſaid it is alſo evident, that obſtruction has many things in common with inflammation, but that no inflammation can be conceived without an obſtruction alſo attending. Beſides, we demonſtrated in the commentary on §. 120, that a violent obſtruction increaſes the velocity of thoſe juices which are to paſs through the pervious veſſels; that is, it occaſions a fever. But ſo ſoon as a fever accompanies the obſtruction, there is then an Inflammation; which may be therefore termed, An obſtruction, with a fever either in the whole or only in ſome particular part of the body.

§. 372. WHICH diſorder may therefore take place, either in the extremities of the ſanguiferous, ſerous, lymphatic, or other leſſer arteries, whoſe mouths being dilated admit the red globules, or the groſs particles of ſome other fluid, incapable of paſſing through their extremities. If blood is transfuſed into thoſe veſſels (*venas*) which are deſtined to lymph or ſpirits, it excites an inflammation, ſays Celſus, p. 5.

It is therefore evident, from the definition given in the preceding aphoriſm, that an inflammation or phlegmon, properly ſo called, can take place only in thoſe veſſels which naturally contain red blood; or elſe in thoſe veſſels, whoſe orifices are ſo dilated by diſeaſe that they admit the red part of the blood. For the particles of a fluid thinner than the red blood, being concreted from any cauſe in the other ſmaller veſſels, may alſo

alſo occaſion an obſtruction in them; and the fluid, preſſing behind the obſtructed particles may, alſo occaſion a greater velocity in thoſe veſſels; without producing any redneſs in the affected part: and then the diſorder is not termed a phlegmon, but an *eryſipelas* or *oedema callidum*, *&c.* as we ſhall explain it at §. 379, 380. But how far the red part of the blood may penetrate, and into what number of the decreaſing ſeries of veſſels it may enter when the orifices are preternaturally dilated, cannot as yet be determined by experiment. In the mean time it is evident, that the red blood may not only enter by diſeaſe into the ſerous veſſels, which naturally contain yellow ſerum, as being the next coloured fluid in groſſneſs to that of the red blood; but it may alſo enter veſſels which are ſtill much ſmaller, and which naturally contain only a pellucid lymph. The white of the eye, which reſembles the brightneſs of a pearl in healthy people, becomes often ſo red by an inflammation, that one may perceive the innumerable ramifications of the veſſels; which, being diſtended with red blood, are viſible enough to the naked eye; when in their natural ſtate they contained only a colourleſs fluid. I have even ſometimes obſerved, in the worſt ſpecies of the opthalmia, a veſſel full of red blood paſſing through the very pellucid ſubſtance of the tunica cornea, conſpicuous even to the naked eye. But here is no one can doubt, but that the veſſels of the cornea are much ſmaller than thoſe of the adnata; ſince in an healthy ſtate they are pellucid as well as their contents: yet a violent inflammation there ariſing often occaſions a red circle, viſible for a conſiderable time around the edge of the cornea, from a diſtenſion of the veſſels with red blood, while there is no defect as yet apparent in the cornea itſelf; but at length the ſmall veſſels of the cornea being gradually dilated, by the violence and continuance of the diſeaſe, they may alſo admit the red part of the blood. From hence it is evident, that a true phlegmon or ſanguine inflammation may ſometimes take place even in very minute veſſels.

As to the paſſage quoted in this aphoriſm from Celſus, which we mentioned before on another account

under the preceding aphoriſm; we are aſſured that the moſt ancient phyſicians comprehended under the name of VEINS, as well thoſe veſſels which we now call *arteries*, as thoſe which are properly called *veins*. It was the opinion of Eraſiſtratus and many of his followers, that the pulſatile veins, which we now call *arteries*, did not contain blood, but air or ſpirit, which occaſioned the pulſation in thoſe veſſels. There were even a great many of his ſect in the time of Galen who boldly maintained this aſſertion, and even promiſed to demonſtrate that the aorta itſelf did not contain any blood; but Galen [a] juſtly laughs at them, and evidently demonſtrates by experiments the falſity of their aſſertion.

So that if we interpret this paſſage of Celſus by the opinion of Eraſiſtratus, he muſt have ſuppoſed an inflammation to ariſe from the blood paſſing out of the veins into the arteries, which were judged to be naturally void of blood; that is, from an heſitation of the blood in foreign veſſels. But we, being at preſent acquainted with the circulation of the blood, know better; though even their aſſertion may be countenanced in one ſenſe, ſince an inflammation in reality ariſes when the blood paſſes out of its proper veſſels into thoſe which naturally contain more ſubtile juices.

See more upon this head in the commentaries on §. 122, where we treated of the different kinds of inflammation, as ariſing from the different diameters of the ſeveral ſeries of decreaſing veſſels.

§. 373. THE ſeat therefore of this diſorder may be every part of the body in which there are reticular diſtributions of ſanguiferous and lymphatic arteries.

After Ruyſch diſcovered by his injections, that, in almoſt all parts of the body, the arteries were divided and diſtributed into the moſt minute branches; and that the ſmall branches ariſing from larger branches communicated with each other, and with the adjacent ſmall

[a] De Anatom. Adminiſtrat. lib. vii. cap. 16. Charter. Tom. IV. p. 164, &c.

ſmall branches; it has from that time been cuſtomary with phyſicians to denominate theſe diſtributions of arteries, net-works (*reticulæ*) or reticular plexuſes, becauſe there are ſmall ſpaces left betwixt the branches, which unite together in the manner of a net. During the many years in which that anatomiſt diligently proſecuted his injections, he often found (as we may perceive in many parts of his works), that there were intermediate ſpaces left betwixt the reticular plexuſes, which ſeemed to be deſtitute of veſſels; but, by a more ſucceſsful repletion, he afterwards demonſtrated innumerable veſſels even there diſtributed, almoſt in the ſame order as he before obſerved in the larger branches. But where-ever the arteries are found to divide into the ſmalleſt branches, there the particles of the blood or lymph may heſitate; being rendered impervious by concretion, or ſome alteration of their figure: Or even from a diminution of the diameters of thoſe ſmall veſſels, by which they are rendered leſs capacious, the free paſſage of thoſe juices which ought naturally to flow through them may be again impeded; and from hence we have an obſtruction, which, with an increaſed motion of the juices (*a tergo*) behind, produces an inflammation. Now, as in almoſt all parts of the body there are ſmall branches derived from the ſanguiferous arteries, which by their minuteneſs exclude the red part of the blood; it is evident, that, by a dilatation of the mouths of thoſe veſſels, the red parts of the blood may miſtake their courſe, and enter the ſmaller veſſels, in the narroweſt parts of which they will ſtop and become impervious: from whence again all the like inflammatory ſymptoms may ariſe.

§. 374. HENCE the ſeat of an inflammation may be as well in the arteries themſelves, as in the veins, nerves, membranes, muſcles, glands, bones, cartilages, and tendons, with all the viſcera; and therefore throughout almoſt every part of the body, but in no part more frequently and violently than in the fat.

Since it is evident, from modern anatomy, that almoſt every part of the body contains veſſels which are capable of being demonſtrated to the eye; it is therefore apparent, that an inflammation may ariſe almoſt throughout the whole body, and eſpecially in thoſe parts which are enumerated in this aphoriſm.

Arteries and veins.] The coats of theſe veſſels are compoſed of other ſmaller veſſels, as is demonſtrable to the eye by injections, in their larger trunks. And even in animals which have been killed after a long hunting or courſing, the whole external ſuperficies of the aorta has been often obſerved to be almoſt black, from the too great diſtenſion of thoſe ſmall veſſels with blood, which are by an admirable intertexture diſtributed through the coats of this largeſt veſſel. We alſo treated of this in the commentary on §. 113, n° 2. where we enumerated a tumour of the ſmaller veſſels ſpent in the coats of the larger, among thoſe cauſes which diminiſh the capacity of the larger veſſels.

Nerves.] The nerves may be conſidered two ways: either as they are compoſed of a tender production of the medulla of the brain, cerebellum, and ſpinal marrow; or, as they are compoſed of tough membranes, or caſes, furniſhed with all ſorts of veſſels, (ſee on §. 181.) in which membranous caſes the very ſoft and pulp-like ſubſtance of the encephalon and ſpinal medulla is ſafely conveyed to all parts of the body. But whether or not, thoſe extremely minute veſſels, which eſcape all our ſenſes, and compoſe the ſubſtance of the nerve properly ſo called, are at any time inflamed, is not ſo evident: but as a very thin fluid paſſes through them from the brain, cerebellum, and ſpinal medulla, as we obſerved in the commentary on §. 181. it therefore ſeems reaſonable to ſuppoſe that a diſorder of the like nature may alſo take place in theſe moſt minute veſſels. But it is abundantly evident, that a true inflammation may take place in thoſe larger veſſels, which (as demonſtrated to the eye by anatomical injections) are diſtributed throughout the conſtituent coats of the nerves.

Membranes.] For we at this time know by anatomical injections, that the moſt ſolid membranes, which the

the ancients imagined to be altogether bloodleſs, are little more than mere intertextures of veſſels.

Muſcles and tendons.] It is evident from injections, that an infinite number of arteries are every way diſperſed through the fleſh or body of the muſcle; and we alſo know, that even the tendons, which appear ſo very white and compact of themſelves, do by anatomical injections become quite red, not only from a repletion of thoſe veſſels which are ſpent in the capſules inveſting the tendons, but alſo of thoſe veſſels which are in the ſame manner diſperſed and run in great numbers betwixt the fibres of the tendon itſelf. From whence it is evident, that an inflammation may be likewiſe here ſeated; and in a violent rheumatiſm the muſcles are often ſo much inflamed, that the moſt excruciating pains ariſe even from the ſlighteſt endeavour to move them.

Glands.] Whether we conſider theſe as mere convolutions or bundles of veſſels; or only hollow cells diſcharging their contained juices by emiſſaries, after they have been ſecerned from the innumerable ſmall veſſels which creep upon the membrane of each cell; the thing will be quite the ſame: for in both caſes the fabric of the gland is aſſerted to be compoſed of an infinite number of ſmall arteries; whence it is evident, that in theſe an inflammation may ariſe, as we are aſſured by daily obſervation in the parotid, ſubmaxillary, axillary, inguinal, and other glands.

Bones.] I believe it was ſufficiently proved in the commentaries on §. 249, 252, 253, in the Hiſtory of Wounds of the Head, that veſſels are conveyed from the perioſteum into the ſubſtance of the bone, and paſs betwixt its lamellæ; and that others enter thro' particular ſmall holes to the diploë of the cranium, and which in other bones extend to the medulla; and hence the ſeparation of the corrupted part, and the reproduction of what is loſt, is aſcribed to the efficacy of thoſe veſſels themſelves which are diſperſed through the ſubſtance of the bone. Therefore an inflammation may ariſe in this ſolid part, either in the arteries which run betwixt the boney lamellæ, or in the veſſels of the medulla itſelf; from whence ariſe

moſt obſtinate and deep pains, a ſpina ventoſa, *&c.* as we ſhall hereafter explain when we come to treat on the Diſeaſes of the Bones. Even Galen [a] has formerly obſerved, that the bones are ſometimes liable to inflammation: for after ſaying that the coats of the veſſels, with the membranes, tendons, and nerves, may be inflamed, he adds, *Wherefore an inflammation does alſo ſometimes penetrate into the bones; and ſometimes it is extended from the bones, when they are firſt affected* [b]. From what preceded the paſſage we have now cited, it is evident, that Galen intends that an inflammation of the incumbent parts may extend not only into the bones, but alſo that an inflammation firſt formed in the bones may be ſometimes extended from them to the other circumjacent parts.

Cartilages.] The cartilages come next in ſtructure to that of the bones; and many of them are in time converted into bones, as is apparent from oſteogeny. But as we find a vaſcular ſtructure in thoſe bones which were once cartilages, it ſeems very probable that the like ſtructure exiſted before in thoſe cartilages: and beſides this, the diligence of anatomiſts has diſcovered and demonſtrated veſſels in the cartilages. Thus Dr Havers [c] affirms, that he has obſerved a hundred pores in the thyroide cartilage which admit veſſels from the perichondrium into the ſubſtance of the cartilage, and other pores which tranſmit the returning veſſels. By a happy injection of young bodies, Ruyſch [d] has obſerved blood-veſſels to penetrate through the body of the patella, and to paſs in great numbers into its meditullium. And in another place [e] he confirms this, in ſaying, that he can demonſtrate to the eye, that there are real blood-veſſels diſtributed within the cartilages themſelves; and that he diſcovered them even in the cartilaginous ſuperficies of the head of the os femoris, and in the margins of the moveable cartilages which are placed in the articulation of the knee, betwixt the ends of the bones. But as theſe veſſels proceed from the

[a] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. p. 315.

[b] Quamobrem oſſa quoque nonnunquam inflammatio attingit, uti et ex ipſis primo affectis aliquando prorumpit ὀρμαται. *Ibid.*

[c] P. 262. [d] Adverſar. Anat. dec. 2. p. 3. [e] Ibid. dec. 3. p. 33.

the contiguous bone into the cartilage, he was surprised that they extended only to about the length of two lines, and never emerged into the outer surface of the cartilage. From hence therefore it is evident, that an inflammation may take place as well in the cartilages as in the bones.

All the viscera, and therefore almost throughout every part of the body.] That the viscera are composed of vessels wonderfully complicated or disposed, and in a different manner in each particular viscus, we are acquainted from the modern art of injection; and the acute diseases of the viscera, which we shall hereafter consider, will evidently show, that an inflammation, with all its consequences, as suppuration, gangrene, scirrhus, *&c.* are sometimes observed in these; and this without excepting the heart itself, notwithstanding Pliny will have it to be the only viscus which does not waste by disease, nor draw any assistance from life, but, being injured, causes instant death, as we observed in the commentary on §. 304. For the pulpy substance of the heart being suppurated in a woman, she discharged a purulent matter for many days by urine; and when she was dead, upon opening her body four months after, an abscess and some small stones were found in the heart, as Hollerius [f] testifies. From hence it is justly concluded, that almost every part of the body is liable to inflammation, since it is demonstrated from the modern anatomy that almost every part of it is vascular.

But is in no part more frequent and obstinate than in the fat.] We are well assured that the cellular membrane extends into almost every part of the body, and acquires different denominations according to the different matter which it contains. For if it contains a white and hard fat in its cells, not fusible without heat, it is then called *tunica adiposa;* but when the matter contained in this membrane is soft and oily, it is then termed *pinguedinosa.* But in those parts of the body where this membrane is thinnest, and its cells are so small that the eye cannot discern the contained oil or fat, it

[f] In Comment. in Coac. Hippoc. p. 814.

it is termed ſimply *celluloſa;* as, for inſtance, in the back of the hand, the forehead, *&c.* But how far this membrane extends itſelf throughout the human body, will appear, if we conſider, that not only all the muſcles and tendons are inveſted with ſuch a cellular membrane, but that even every muſcular fibre, as far as the eye and patient hand of the moſt acute and dextrous anatomiſt has been able to penetrate, is alſo inveſted with the like cellular membrane. Almoſt every veſſel in the body runs in or through ſuch a cellular ſubſtance, which in part conſtitutes the fabric of the veſſels and viſcera themſelves. From whence it is evident, that an inflammation may frequently ariſe in this cellular or adipoſe membrane; and when once ſeated in this part, it uſually proves very ſtubborn, being frequently incapable of a diſcuſſion, and tends either to a ſuppuration or a gangrene. Now as the arteries which are diſperſed through this membrane do uſually in their natural ſtate ſecern a fat oil or unctuous liniment, ſerving to lubricate the parts, for which uſe it is depoſited in the cells of this membrane; it would therefore ſeem, that theſe veſſels being dilated or broken by an inflammation, will occaſion the red part of the blood itſelf to tranſude and be accumulated in theſe cells; and from hence that hard and red tumour ſeems to ariſe, which accompanies the true phlegmon, whoſe ſeat is almoſt conſtantly in this cellular membrane only. Galen has very well expreſſed this matter in a ſentence which we quoted before upon another occaſion, in the commentary on §. 118. *When the hot blood flows more plentifully into any part of the animal, its larger veſſels will be immediately diſtended; which not being able to ſupport the plenitude, the blood will then flow from them into the ſmaller veſſels. But ſoon after this, the ſmall veſſels not being ſufficient to retain it, the blood will tranſude or eſcape into thoſe large ſpaces which lie betwixt the veſſels, ſo as to occupy all of them, which are in the compoſition of the fleſh* [g]. But by *fleſh* Galen here underſtands the adipoſe

[g] Quum ſanguis calidus copioſior in aliquam animalis partem procubuit, majora ejus vaſa protinus diſtenduntur, quæ plenitudinem non ferunt;

adipose or cellular membrane, as is sufficiently evident from what he writes in the last chapter of the same book. Besides this, it is also confirmed by the event of inflammation, that the seat of it is most frequently in the cellular membrane. For if a violent inflammation be followed with a suppuration or a gangrene, the confined matter or gangrenous ichor is observed, upon perforating the skin, to be lodged always in the cellular membrane. Thus I saw, in a frightful gangrene which extended through the leg from the knee to the ends of the toes, that a large part of the panniculus adiposus came away while the subjacent muscles and tendons were quite sound.

§. 375. THIS stagnation (371) is caused in the smallest arteries, 1. By every thing which contracts or diminishes the conical or cylindrical ends of the small vessels, in such a manner that their diameter or opening becomes less than the diameter of a blood-globule; whether this be done by pressure, distraction, contortion, rupture, contusion, burning, erosion, or shrinking of their membranes. To these add, Heat; violent motion; foreign bodies in the flesh; ligatures; incumbent weights; acrid substances, either taken as food, or applied externally; severe cold; too much friction; and all the causes of wounds, contusions, erosions, fractures, luxations, and obstructions.

In the definition of an inflammation in §. 371, two things were considered: namely, A stagnation of the red parts of the blood in the smallest arteries; and, A pressure or attrition from the blood pressing behind with a greater impetus against that which was obstructed. In this aphorism are enumerated those causes which

runt; ab his deinceps quæ minora sunt. Mox ubi nec in iis satis continetur, exsudat foras in illa ampla spatia, quæ inter vasa sunt, sic ut etiam omnia, quæ in composita carne habentur, loca occupet. *Meth. Med. lib. x. cap. 6. Charter. Tom. X. p. 233.*

which occaſion that ſtagnation in the ſmalleſt arteries; which yet, in their natural ſtate, are capable of tranſmitting the red part of the blood through their ſmalleſt extremities.

1. The arteries which convey the red blood, having firſt carried off the thinner parts by their lateral branches for various purpoſes, do then tranſmit the red globules (which are of a ſize too large to enter the ſmaller veſſels) from their ſmalleſt extremities into the veins, with which they form a continued veſſel. Therefore where one of theſe ſmaller arteries terminates, there the vein begins: now the artery, in its courſe, always diminiſhes gradually from a larger capacity to a leſs; but the veins are ſmalleſt at their origin, and gradually enlarge through their whole courſe. Hence the humours paſs, in the arteries, from the baſis of the cone to the apex; but, in the veins, they paſs from the vertex towards the baſis of the cone. But in thoſe parts where the artery becomes ſmalleſt, and forms itſelf into the continued ſmalleſt veins, there the veſſel ſeems to be cylindrical, at leaſt for a ſmall ſpace, the ſides neither converging nor diverging; and if the cylindrical veſſel proceeds, either towards the artery or towards the vein, it then aſſumes the figure of an erect or an inverſed cone. But in this part where the ſanguiferous artery terminates, and the ſmalleſt vein thence ariſing begins, there is the ſmalleſt diameter, or the narroweſt part of the veſſel; and therefore the particles of the blood, if they become impervious from any cauſe, will ſtagnate in this part. If now we again conſider, that theſe extremities of the veſſels may be contracted many ways, it will be evident, that in ſuch a caſe the juices will there ſtagnate, and be incapable of paſſing through theſe anaſtomoſes. And from hence it is alſo evident, why the text contains the terms conical and cylindrical.

It was ſaid before in the commentary on §. 115, that the ſmalleſt particles of the circulating humours in animals, viſible by the microſcope, appear ſpherical; and towards the laſt extremities of the veſſels only one globule has been obſerved able to paſs through at a time, and

and that even with ſome difficulty. From whence it is ſufficiently apparent, that the anaſtomoſes, or ſmalleſt extremities of the veſſels, being contracted or diminiſhed from any cauſe, will obſtruct the free paſſage of the humours, by diminiſhing the capacity of the veſſel; ſince the bulk of the particles to be tranſmitted, does in this caſe exceed the diameters of the orifices through which they are to paſs; and therefore an obſtruction muſt conſequently ariſe, which is always an inſeparable companion of inflammation, as is evident from the definition given of it in §. 107.

But ſince (as was ſaid in the commentary on §. 109.) every ſection of our veſſels, which is made perpendicular to their axis, is a circle, and as that figure has the greateſt area of any that has equal ſides; it is from thence evident again, that every cauſe, which is able to change the figure of the veſſels, may occaſion a ſtagnation of the humours to be tranſmitted through the laſt extremities of the arteries. But of theſe cauſes the principal are thoſe enumerated in this aphoriſm, many of which have been explained before.

Preſſure, diſtraction, contortion.] Concerning theſe you may conſult what has been ſaid in the commentaries on §. 112, n° 1, 2, 3.

Rupture.] The orifices of divided veſſels naturally contract, and obſtruct the free courſe of the juices which ought to flow through them, as was demonſtrated in the commentaries on §. 159. and §. 158, n° 2, 4, and it is alſo evident from what was there ſaid on n° 5. that a true inflammation may follow from that cauſe.

Contuſion.] Since the idea of contuſion includes an aſſemblage of ſmall wounds, as was ſaid on §. 322, it is therefore evident why a ſtagnation of the humours is that way occaſioned. Add to this, that a contuſion always reſults from the preſſure of ſome hard and obtuſe body injuring the ſolid parts, which cannot be done without compreſſing or changing the figure of the veſſels.

By burning, eroſion, ſhrinking, *&c.*] For by all theſe ways a part is either totally diſtroyed, as by the action of fire or ſtrong cauſtics; whence the living veſſels in the margin of the diſorder are obſtructed; whence a ſtagna-

ſtagnation and inflammation follow: Or if the action of theſe cauſes is milder, by a contraction of the ſolids and an inſpiſſation of the fluids many of the veſſels will be rendered impervious; from whence again the ſame diſorders will ariſe, as we ſhall hereafter explain more at large when we come to treat of burnings.

Heat.] That is, when the degree of it much exceeds the heat of a perſon in health. But we ſhall hereafter demonſtrate, when we come to treat of an increaſed heat as a ſymptom of fevers, §. 689, that the ſolid fibres are therefore dried, contracted, and made rigid: and then the rigidity of the fibres, being increaſed, will augment the contractile power of the veſſels which they compoſe; whence their capacities will be diminiſhed, and an obſtruction thence formed, as was demonſtrated in the commentaries on §. 113. If now it be alſo conſidered, that too great heat evaporates the moſt ſubtile parts of the fluids; and that after this the blood and its ſerum concrete into ſolid maſſes hardly capable of being again diſſolved; it will be from thence ſufficiently apparent, that an increaſed heat is juſtly reckoned among the cauſes of inflammation.

Violent motion.] Conſult what has been ſaid in the commentaries on §. 100. where it was proved, that an obſtruction, inflammation, and all their conſequences, may ariſe barely from an increaſed motion.

Foreign bodies in the fleſh.] When any ſharp-pointed body is fixed in the fleſh, it injures the veſſels, and compreſſes thoſe which are adjacent, while at the ſame time it cauſes a continual pain and irritation. It is therefore very apparent, that an inflammation muſt from thence ariſe: eſpecially when ſuch body is fixed in parts that are very ſenſible; for then the ſymptoms are ſeldom removed, till the offending body is diſcharged by a ſuppuration made by nature. Ruyſch [a] gives us a remarkable inſtance of this kind in a girl, who ſwallowed a needle, unknown to her parents; after which a hard inflammatory tumour was formed in the groin, accompanied with a violent fever and intenſe pain. This tumour was brought to ſuppuration by the

[a] Obſerv. Anatom. Chirurg. nº 55.

the application of emollient cataplasms; and being opened with a lancet, the needle was discharged rusty, with a considerable quantity of matter mixed with some of the intestinal fæces. This dangerous disorder was yet happily cured. But there are many observations, which teach us, that needles and other such sharp-pointed bodies may lie dormant for a considerable time in the panniculus adiposus, without giving any great uneasiness. Thus I knew a turner, who had, six years before, a splinter of wood run into the flesh betwixt his thumb and fore-finger; where it continued, and might easily be felt, for so long a time, without giving any great uneasiness or disturbance to him in his daily labour; and therefore he would never suffer it to be extracted by a surgeon, who notwithstanding told him the ill consequences that might follow. I likewise saw another instance which proves the same thing. A girl complained of a pricking pain about the arm: after a diligent examination of the part, I could not find any thing amiss, even by handling it all over; and she particularly observed, that the pain did not always trouble her, but only in some certain motions. I ordered the application of a galbanum plaister, and visited her again some days after: but as she found no relief from thence, in making a second and more diligent examination of the part I felt something prick my finger, and afterwards perceived the sharp point of the needle sticking out through the injured skin. I extracted the needle with its thread, which was six inches long, by a pair of forceps: and then she presently recollected, that, about six weeks before, she had lost that needle while she was intent upon her work.

Ligatures.] These diminish the capacity of the vessels by compression: but they act more upon the veins than the arteries, since the former have their coats much weaker; and they likewise act more upon those veins which are placed in the surface of the body. But when ligatures are drawn very tight, they then compress the arteries as well as the veins. This is evident in the daily performance of phlebotomy; where, if the ligature is moderately tight, the blood runs free-

ly from the inciſed vein: but if the ligature is drawn too tight, it compreſſes the artery likewiſe, and therefore little or no blood follows; but when the ſurgeon perceives this, he ſlackens the ligature, and by that means promotes the efflux of the blood. See what has been ſaid in the commentary on §. 112, no 4. where we alſo gave a reaſon why incumbent weights produce obſtructions by compreſſing the veſſels externally.

Acrid ſubſtances, either taken as food, or applied externally.] It ſeems to be a property of almoſt all parts of our body, whether external or internal, to contract themſelves upon the application of any thing acrimonious; and there are many experiments which prove the ſame thing. If a little drop of vinegar is ſprinkled into the eye, the eye-lids are ſo ſtrongly contracted, even againſt the perſon's inclination, that they require a conſiderable force to open them. And acrid poiſons, taken into the ſtomach and inteſtines, occaſion violent contractions in them; from whence, with the confined and heated air, great inflations ariſe. Upon applying a ſmall drop of oil of vitriol with a probe to the naked inteſtine of a dog, I obſerved it immediately contract in the ſame manner as if it was conſtringed by tying a ligature round it. It is therefore probable, that if acrid ſubſtances reach to the ſmaller veſſels, they will likewiſe be brought into the ſame contractions; from whence follows an obſtruction, which, joined with an increaſed circulation of the blood, may produce an inflammation. Thus when the blood itſelf is infected with an acid acrimony, it is obſerved to produce itchings, obſtructions, puſtules, and little ulcers about the cutaneous veſſels, as was ſaid at §. 64. When the ſtaganting ſerum, which diſtends the legs of dropſical patients, begins to turn acrid, the ſkin is often inflamed. But if the force of the acrid ſubſtance is ſo great, eſpecially when externally applied, as to diſſolve the continuity of the veſſels, it is ſufficiently evident, from what has been before ſaid, that then the inflammation may be produced in a much greater degree.

Severe cold.] It is evident from experience, that cold contracts the dimenſions of all ſolid bodies; and there-

therefore it muſt contract the capacity of the veſſels. It was alſo proved in the commentary on §. 117, that the particles of the blood cohere together by cold: and therefore, by both theſe effects, cold may produce an obſtruction and inflammation; and that in ſo great a degree, as to be often followed with a gangrene in a very little time, as we ſhall ſhew hereafter at §. 454, 455. From hence too, perhaps, the reaſon may appear, why a pleuriſy ſo frequently follows when huſbandmen indiſcreetly expoſe themſelves to the cold air when they return ſweating from their labour: for the inſpired and cold air comes almoſt into contact with the intercoſtal veſſels, while only the very thin membrane of the pulmonary veſicles is interpoſed betwixt them; and at the ſame time the cold air being freely admitted to the body which is not well covered, increaſes the diſorder externally.

Too much friction.] Of what efficacy friction is, in removing obſtructions, was ſaid before in the commentary on §. 133, n° 3. But when the friction has been continued too violently or too long a time, it may produce an ardent fever, even in the moſt cold and dropſical habits, as we explained before under §. 28, n° 2. For the motion or return of the venous blood being thus accelerated, the heart will contract more ſtrongly and frequently, whence an increaſed motion of the circulation; which being too much increaſed produces an inflammation, as we demonſtrated in the commentary on §. 100. Thus we obſerve, that violent frictions make the parts of our bodies grow hot, red, ſwelled, and painful; and all theſe are the true ſigns of a preſent phlegmon, which will indeed ſoon go off if the friction is not continued too long nor in too violent a degree: for when ſailors on board a ſhip ſuddenly let the ropes run through their hands to ſlacken the ſails againſt the wind, if they graſp them too firmly, a moſt violent attrition, heat, and pain, thence ariſe in a moment, ſo as to raiſe the cuticle into bliſters like thoſe of a gangrene. If now we alſo conſider, that by frictions the red part of the blood may be driven into many of the ſmaller veſſels, into which it never enters in a

natural ſtate, (as is evident from the redneſs which accompanies almoſt every friction), it will be ſtill more evident how an inflammation may be produced by too much friction.

All the cauſes of wounds, contuſions, *&c.*] Concerning all theſe we have ſufficiently treated before under thoſe reſpective diſorders.

§. 376. THE ſame ſtagnation is alſo produced, 2. By every thing which occludes the paſſage of the veſſels, and applies an acrimony to them at the ſame time, whether externally or internally; ſuch as ſubſtances which are both oily and ſaline, acrid, *&c.*

We know for certain, that the whole ſurface of the body, both external and internal, is perſpirable: that is, a very thin vapour is expelled every moment of life through the ſmalleſt arterial ducts which open outwards; which vapour being condenſed upon the poliſhed ſurface of a cold looking-glaſs, or any other metalline body, forms a thin water, which afterwards entirely exhales without leaving any fæces. If now the paſſages through which the ſaid perſpirable and very thin vapour ought to be expelled, are by any cauſe obſtructed, thoſe very minute veſſels will be dilated by the impulſe of the confined humour; and being thus dilated, they may admit groſſer juices, from whence an obſtruction and ſtagnation conſequently follow. But the leaſt exhaling veſſels being thus obſtructed, thoſe which are next in magnitude to them, not being able to diſcharge the thinneſt part of their fluid into the exhaling veſſels as before, they alſo will be dilated; and thus the diſorder will be propagated from the ſmalleſt exhaling veſſels even to the groſs blood-veſſels.

But as this exhaling vapour reſembles water almoſt in every reſpect; and as oil prevents the entrance of water into very minute glaſs tubes, or at leaſt renders the entrance of it more difficult; this may therefore be the reaſon why inflammations and an eryſipelas ſo frequently

quently arise from the external application of oil. Thus we read, that the bodies of the athletæ or champions were anointed with oil, that they might not be too much exhausted by sweat: and after bathing it was customary to use unction, to prevent the moisture from evaporating which had been acquired in the bath, and to prevent the native heat from escaping through the pores, which had been set open by the warm bath [a]. In many people, the skin itself is immediately inflamed by the application of a fat or oily unguent or emplaister: and something of the same nature seems to take place in the internal parts, since many people are inflamed or feverish soon after the taking of oily substances, and especially lard. If now these oily or fat substances also contain an acrimony, very obstinate inflammations may thence arise. Oil of almonds, which is so mild or sweet when it has been lately expressed, does by the summer's heat grow rancid in a few days time; and at length acquires so great an acrimony, that it inflames the fauces, though swallowed in but a very small quantity. The same is also true with respect to butter, which becomes rank either by long keeping or by frying in a pan. But an acrimony mixed with an oil or fat is the more prejudicial, because it most firmly adheres to the part to which it is applied, nor can it easily be washed off by watery liquors. The berries of the spurge laurel of the shops, (*Thymelææ lauri folio semper virente fructus*,) being pressed by the fingers, discharge a mere oil, which at first deceives the palate with a mild taste, but soon after it so much inflames the fauces, that, when I unwarily tasted it, it almost suffocated me, insomuch that I was not able entirely to remove its troublesome acrimony, even by washing my mouth continually with a mixture of water, vinegar, and honey, for the space of two whole hours. Thus also those caustic and empyreumatic oils, which are obtained by an intense fire from hartshorn, lignum guaiacum, and the like, (which are often recommended for the cure of stiff joints and for dispersing impacted matter,) being imprudently applied to the skin, have

[a] Hier. Mercur. de Arte Gymnastica, lib. i. cap. 9. p. 36, 37.

been obſerved to occaſion the moſt malignant inflammations, and ſometimes even to produce a gangrene: For in theſe we find the greateſt tenacity of oils, which obſtructs the pores and ſmall veſſels; and this alſo combined with a violent acrimony, by which the irritated veſſels are contracted.

§. 377. THIRDLY, Every thing which cauſes the blood to concrete or cohere together: ſuch as, Too great motion; a conſumption of the thinner parts of the blood, by ſweats, urine, ſpitting, or a diarrhæa; to which add, Every thing that coagulates the blood.

It was ſaid, in the Hiſtory of Obſtruction, that it aroſe from the exceſs of the bulk of the tranſient matter above the capacity of the tranſmitting veſſel; and that therefore the general cauſes were, Too great a narrowneſs of the veſſels, or an increaſe of bulk in the particles of the fluid to be tranſmitted, or a combination of thoſe two cauſes acting at one and the ſame time. In the two preceding aphoriſms we conſidered the cauſes producing a ſtagnation in the ſmalleſt ſanguiferous arteries, ſo far as it aroſe from a contraction of the veſſels: but in this place we are to treat of thoſe cauſes which make the blood cohere or run into ſuch groſs particles, that it cannot paſs through the narrow extremities of the ſmaller arteries, even though their diameters or capacities remain the ſame. Now among theſe cauſes the principal are,

Too great motion.] In the commentary on §. 100, where we treated of the effects which follow from an increaſed motion or circulation of the blood as a cauſe, it was demonſtrated, that the blood acquired, by this increaſed motion, ſuch a diſpoſition as rendered it more apt to concrete. For in the blood there is always a tendency towards concretion; which is the ſtronger in proportion to the ſtronger action of the veſſels upon their contained blood: For the blood of ſtrong men taken from a vein, immediately congeals; and, after ſtanding

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ing a while at reſt, exhibits much cruor or craſſamentum, and but little ſerum: the contrary of all which we obſerve in the blood of a weak girl. But all this depends on the more or leſs powerful action of the veſſels upon their contained blood. But by an increaſed motion, the action of the veſſels in a given time is more frequently and ſtrongly repeated upon the contained fluids, by which means they acquire a greater condenſation or compactneſs. Beſides this, by an increaſed motion the moſt fluid parts are diſſipated; becauſe a greater quantity of blood is applied in a given time to the organs which from thence ſeparate and diſcharge the thinner juices: and from hence again the tendency of the blood to concretion will be augmented. Add to this, that an increaſed motion is followed by an increaſe of heat; from whence likewiſe the blood may be ſo inſpiſſated, that it can be no longer able to paſs through the narrow extremities of the ſmaller arteries. And therefore, in acute diſeaſes, when the heat is much increaſed, the impaired functions of the brain and the difficulty of reſpiration immediately denote that there is ſuch an inſpiſſation of the blood as allows it no longer to paſs freely through the narroweſt paſſages of the ſmaller arteries in theſe viſcera.

A conſumption of the thinner parts of the blood by ſweats.] We are taught by obſervations (as we mentioned before in the commentary on §. 93), that the groſſeſt particles in the human blood are the red globules; but that there are a great many ſorts of thinner juices interpoſed, by which the mutual contact and coheſion of the larger globules to each other are impeded. So ſoon, therefore, as this more thin and fluid part of the blood is drawn off by any cauſe, the larger globules will then come into contact; and, being moſt ſtrongly preſſed together at the ends of the ſmaller arteries, they will there combine or concrete; from whence a ſtagnation of them, and an obſtruction of the veſſels, follow. Thus, when night-ſweats begin to waſte a conſumptive patient, the impervious blood begins to heſitate in the ſmall veſſels of the ſkin, and occaſions inflammatory puſtules. And for this reaſon it

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is that Hippocrates condemns ſweats in the beginning of acute diſeaſes; and Sydenham has obſerved their pernicious conſequence when the patient has profuſe ſweats in the beginning of the ſmall-pox.

Urine.] In hyſterical and hypochondriacal diſorders, there is often an incredible quantity of urine diſcharged, almoſt as thin as water, eſpecially when the mind has been diſturbed by any violent affection: but the blood being thus deprived of its diluting vehicle, its groſſer parts begin to concrete, whence proceed very malignant inflammations; or elſe the craſſamentum of the blood is depoſited about the abdominal viſcera, where it uſually produces the moſt obſtinate obſtructions. And from hence ſo often ariſe thoſe hyſterical or hypochondriacal paſſions, which are aſcribed to the atra bilis.

Spitting.] If we examine the ſaliva which naturally flows from the mouth of a perſon in health, it appears ſufficiently thin, (for the mucus of the fauces and adjacent parts being mixed with the ſaliva by the motion of the tongue, renders it more tenacious:) and by chemical analyſis it appears to conſiſt almoſt entirely of water; for out of ſixty ounces of ſaliva, there may be almoſt fifty-nine ounces drawn over by a gentle fire, which reſemble water in all reſpects. The ſaliva alſo does not concrete with the heat of boiling water; from whence it appears to be thinner than the ſerum of the blood. A copious diſcharge by ſpitting will therefore drain off a great part of the thinner juices in the body; and the blood being deprived thereof is rendered leſs pervious or fluid. And for this reaſon, thoſe who by an ill cuſtom, or an abuſe of tobacco, daily throw away large quantities of their ſaliva, are ſo frequently afflicted with the worſt kinds of obſtructions in their abdominal viſcera. After all the internal parts of the mouth have been a long time covered with thick aphthæ; when they fall off, an incredible quantity of ſaliva is diſcharged from the dilated veſſels; inſomuch that if the immoderate flux or ſpitting is not removed by proper remedies, the patient is often exhauſted and killed, or elſe afflicted with chronical diſeaſes for a long time afterwards;

erwards; becauſe the blood being thus deprived of its more fluid parts, produces incorrigible obſtructions. Nor is it any objection here, that the blood does not become inſpiſſated by a continual diſcharge of ſaliva in great quantities, continued often for ſeveral weeks together, in a mercurial ſalivation: for in this caſe there is not a diſcharge of the ſaliva properly ſo called; but all the humours of the body, being diſſolved into a putrid water by the action of the mercury, are this way evacuated: ſo that in this caſe the blood is not deprived of its moſt fluid parts, while the groſſer parts are left behind; but even the red part of the blood itſelf undergoes a true diſſolution; and therefore the patient may very well ſupport this diſcharge, if the freſh juices of good aliments continually ſupply the place of the diſcharged humours.

Diarrhœas.] For this way likewiſe the thinner parts of the blood may be diſcharged from the body, as is ſufficiently evident. Therefore Hippocrates, in his Prænotiones Coacæ, pronounces a profuſe diarrhœa to be fatal in an ardent fever: for ſince in this diſeaſe the blood begins to be impervious in the ſmaller arteries, by diſcharging the thinner parts of the juices in a flux the diſorder will be rendered incurable.

Which coagulate.] Concerning theſe you may conſult what has been ſaid in the commentary on §. 117.

. 378. THE like diſorder is occaſioned in the lymphatic arteries, 1. By all cauſes which dilate their orifices wide enough to admit the groſſer parts of the blood; which, being driven further into theſe veſſels, are ſtopped againſt their converging ſides: and then the ſame conſequences follow here as we explained before in . 377; that is, there will be a dilatation of the veſſel towards its origin, and a violent motion of the arterial humour behind the obſtruction. 2. By all the cauſes which are commonly productive of other inflammations (375, 376).

Hitherto

Hitherto we have conſidered thoſe cauſes which obſtruct the free courſe of the groſs or red part of the blood through the ſmalleſt ſanguiferous arteries; which cauſes acted either by diminiſhing the capacity of the veſſels, or by rendering the blood itſelf impervious. But beſides this, we alſo obſerve a true ſanguine or red inflammation in thoſe veſſels which naturally exclude the red parts of the blood by the ſmallneſs of their diameters. Of this we have a notable inſtance in the ophthalmia, in which the whole tunica adnata or white of the eye, and even the cornea itſelf, look red, by a diſtenſion of their ſmall veſſels with the red part of the blood, to ſuch a degree that they become viſible to the naked eye, whereas naturally there was no red blood contained in thoſe veſſels. Such an inflammation muſt therefore have been preceded by certain cauſes, which put theſe dilated veſſels in a condition to receive the red parts of the blood. Now it is evident, that the red parts of the blood being once entered into theſe ſmaller veſſels, muſt produce an obſtruction; ſince it will continually ſtop againſt the narrower ſides of theſe converging veſſels. Thus an obſtruction here ariſes, tho' there is no diminution of the capacity of the veſſels, nor any augmentation of the particles of the fluid which ought to be tranſmitted. And this diſorder is properly enough termed an obſtruction (*per errorem loci*) by the blood miſtaking its courſe; ſince in this caſe the red part of the blood ſtagnates, having entered the ſmaller pellucid veſſels, and not being capable of paſſing thro' their ſmalleſt extremities: ſo that the whole eſſence of the diſorder conſiſts in the red blood eſcaping into other veſſels. See concerning this what has been ſaid in the commentary on §. 118, where it was alſo proved, that this diſorder may take place in every part of the body in which there are veſſels carrying a fluid thinner than the blood derived from the ſanguiferous arteries. This diſorder therefore, or error of place, can never be ſeated in the blood-veſſels, ſince we never obſerved any particles in healthy blood of a larger magnitude than that of the red globules; but it may take place in the ſeveral ſeries of the other decreaſing veſſels. How far

this

this red part of the blood may penetrate into thoſe veſſels, is not as yet aſcertained by experiment; but this we know, that in many diſeaſes it often paſſes into veſſels which are much ſmaller than thoſe which contain the ſerum of the blood; as will appear evidently, if we conſider that it ſometimes enters even the ſmall veſſels of the tunica cornea of the eye. But ſince all that fluid which is thinner than the red and ſerous globules of the blood, is generally denominated *lymph*; therefore thoſe veſſels through which the thinner fluid paſſes, are alſo termed *lymphatics*; and theſe are either arteries or veins. But it was proved in the commentary on §. 119. that an obſtruction cannot be ſeated in the veins, unleſs the courſe of their fluids is intercepted by an external compreſſion: therefore the groſſer particles of the blood can form obſtructions by an errror of place in the *lymphatic arteries* only; under which name we include all arteries which admit fluids whoſe particles are ſmaller than thoſe of the red and ſerous globules of the blood, refuſing entrance to theſe laſt.

Therefore, in order to form this diſorder by an error of place, it is required for the mouths of the lymphatic arteries to be ſo far dilated that they may admit the red part of the blood. Now it was demonſtrated, in the commentary on §. 26, that the amplitude or capacity of the veſſels depended on two different cauſes; namely, the reſiſtance of their ſides, and the momentum or force of the impelled fluid; and that therefore it was to be eſtimated in a ratio compounded of the impulſe of the fluid directly, and of the reſiſtance of their ſides inverſely. If therefore a greater laxity ſhould from any cauſe ariſe in the beginning of the lymphatic arteries, the force of the impelled fluid remaining the ſame, they will be dilated; and, on the other hand, the impulſe of the fluids being increaſed, while the reſiſtance of the ſides of thoſe veſſels remains the ſame, it will produce the like effect; and this effect will be more eſpecially produced from both theſe cauſes concurring at the ſame time. See what has been ſaid concerning the laxity of the veſſels, as a cauſe of the blood's miſtaking its courſe, in the commentary on §. 118. And why

why the orifices of the veſſels are dilated by an increaſed motion of the arterial fluid, was explained in the commentary on §. 100. But what has been now ſaid is alſo confirmed by experiments; for any part of the body being expoſed to the vapours of warm water, will ſwell and look redder than uſual, from the ingreſs of the red blood into the ſmaller relaxed veſſels. And after violent running, we ſee that the whole external ſkin looks red, and the eyes are in a manner ſuffuſed with blood from the entrance of that fluid into the ſmaller pellucid veſſels, which are dilated by the greater impulſe communicated to the fluids.

2. When once the red blood is entered into a lymphatic veſſel, it is evident enough, that all thoſe cauſes which are capable of diminiſhing the capacity of the larger or ſanguiferous arteries, may produce the ſame effects when applied to theſe ſmaller arteries. But of theſe we treated in the two aphoriſms here cited.

§. 379. HENCE we ſee, that the ſame diſorders may take place in every conical veſſel, in which the humours flow from a larger to a leſs capacity; for as in the red blood, ſo in the lymph, there are probably many parts groſſer than the reſt.

In healthy blood, which has been lately drawn from a ſmall wound, and viewed by a microſcope in capillary glaſs-tubes, we diſtinguiſh ſeveral ſorts of particles; and the ſame we are likewiſe able to diſcern in the pellucid membranes of living animals, in which the circulation of the humours through the veſſels may be ſeen. For here we perceive globules ſwimming in a thinner pellucid fluid; in which laſt we can diſcover nothing farther, becauſe the pellucidity makes the fluid appear homogeneous. But it ſeems highly probable, that, in the thin or pellucid lymph of the blood, there are alſo ſome parts groſſer than others, which by their determinate magnitudes are contained in proportionable veſſels, into ſmaller than which they cannot

cannot naturally enter. For unleſs the red globules were ſo large as to prevent them (in an healthy ſtate) from entering the ſerous and ſmaller veſſels; it is evident that all the blood would be derived into the ſmaller veſſels, while the larger veſſels would remain quite empty. The ſame is alſo true in thoſe veſſels which convey the ſerum of the blood, and in the ſeveral ſeries of the ſmaller veſſels. From hence, when the blood becomes too fluid in diſeaſes, it is either exhaled, or diſcharged out of the body by the emunctories, or is accumulated in the larger or ſmaller cavities of the body, as we obſerve in dropſies: and then the larger veſſels always collapſe for want of a ſufficient quantity of the thicker part of the blood which uſed to diſtend them. Now the ſame thing ſeems to be true in the other decreaſing ſeries of the veſſels, from the largeſt ſanguiferous down to the moſt minute exhaling ones; that is to ſay, every ſeries of veſſels have their proper and reſpective fluids, which are compoſed of ſuch groſs particles, that they cannot enter into the ſmaller veſſels of the next ſucceeding order, but are confined each to their reſpective veſſels. This being premiſed, if the capacity of theſe converging veſſels is by any cauſe diminiſhed, or the particles combined which uſed to paſs through the narrow extremities of thoſe veſſels, an inflammation may follow; but not a red one, as being ſeated in the ſmalleſt and pellucid veſſels. If, again, the orifices of the ſmall veſſels of the next ſucceeding order are by a relaxation, or too violent a motion, ſo dilated as to admit the groſſer particles of the next larger ſeries of veſſels, it muſt produce the like ſpecies of diſorder by error of place. There may be therefore as many different kinds of inflammations as there are different ſeries of veſſels interpoſed betwixt thoſe which are the largeſt and the ſmalleſt in the body: And they may be there produced two ways; either from a narrowneſs of the veſſels, and an impervioufneſs of the fluids from the largeneſs of their particles; or elſe by an error of place, when the groſſer particles paſs out of the larger veſſels into the dilated orifices of the ſmaller veſſels. But in the largeſt

or ſanguiferous veſſels, an inflammation can never be produced by an error of place, ſince there are no particles found in the blood groſſer than thoſe of the red globules. Whether or not the rheumatiſm, and gout of the joints and feet, ariſe from an inflammation of the ſmaller veſſels, is a queſtion concerning which you may conſult what has been ſaid in the commentary on §. 122.

§. 380. FROM hence the true difference betwixt a phlegmon, eryſipelas, oedema, and a ſcirrhus with an inflammation, is ſufficiently apparent.

Phlegmon.] Though the ancients uſed this name for any kind of inflammation; yet it was afterwards cuſtomary (as we ſaid in the commentary on §. 370. from the authority of Galen and Ægineta) to apply this term only to a preternatural tumour accompanied with redneſs, reſiſtance, heat, pulſation, and pain, in ſome ſoft part; with a fever attending, either in the whole body, or in the part itſelf. But this is occaſioned from a ſtagnation of the red blood about the extremities of the arteries, whilſt the reſt of the blood acts with a greater impulſe from the force of the heart and arteries urging it forward behind the obſtructions. A phlegmon may therefore ariſe either in the ſmalleſt extremities of the ſanguiferous arteries; or, which is more frequent, it may be produced by an infarction of the red blood into the ſerous or lymphatic arteries by an error of place. But it is evident, by what has been ſaid in the commentary on §. 374. that the ſeat of a true phlegmon is moſt frequently in the adipoſe membrane.

Erſipelas.] Galen defines an eryſipelas in ſuch a manner, that it would ſeem entirely to reſemble a true phlegmon: for he ſays, *If a fluxion or congeſtion ariſes from a mixture of blood and yellow bile hotter than uſual, or even from hot blood alone much attenuated, the diſorder is termed an* eryſipelas; *which has a much greater heat than an inflammation, and a yellower aſpect. If you touch or preſs it, the blood readily diſappears, and again returns, appearing very thin and florid. But yet an eryſi-*

pelas

pelas is not ſo painful as an inflammation; nor is it, like any kind of inflammation, accompanied with a pulſation, reſiſtance, or diſtenſion. Even ſometimes it appears very moderate: eſpecially when it is ſpread only about the ſkin, without at all injuring the ſubjacent fleſh; as it moſt generally does, and is then a true eryſipelas [c]. And a little after he adds, That a true eryſipelas is a diſorder of the ſkin only. But as the part invaded with an eryſipelas appeared of a yellowiſh red colour, the ancient phyſicians accuſed the bile as the principal cauſe: but we at preſent know that the ſerum of the blood is naturally yellow; ſo that if a little cruor ſtagnates with much ſerum in the pellucid veſſels, which are obſtructed and inflamed, the affected part will then appear of a reddiſh yellow colour. Hence alſo appears the affinity which is betwixt an eryſipelas and a phlegmon, ſince they only differ in the magnitude of the obſtructing particles: for in a phlegmon the red part of the blood is accumulated in the obſtructed and diſtended veſſels; but, in an eryſipelas, the ſerum of the blood, mixed with a little cruor, becomes impervious in the ſame manner: alſo, the ſeat of a phlegmon is chiefly in the membrana adipoſa; whereas an eryſipelas invades either the external integuments of the body, or the internal membranous parts. And from hence alſo it appears, that an eryſipelas may degenerate into a phlegmon, from the dilated veſſels admitting a larger quantity of the red blood, and ſpreading the diſorder into the adipoſe membrane: alſo that ſometimes an inflammation may ariſe, as it were betwixt an eryſipelas and a phlegmon; in which caſe the ancient phyſicians termed the diſorder by a name compounded from both

[c] Si ex ſanguine et flava bile juſto calidioribus fluxio miſta fuerit, aut ex ſanguine quidem, ſed fervido, et ſubſtantia tenuiſſimo, Eryſipelas vocatur ille affectus, multo calidior inflammatione, et aſpectu flavior. Et ſi tetigeris, ſanguis facile ſubfugit, rurſuſque affluit, exquiſite tenuis et ruber apparens. Non tamen ſimiliter dolet eryſipelas ac inflammatio: neque ſecundum ullam inflammationis ſpeciem aut pulſum, aut compreſſionem, aut diſtenſionem ſimilem adfert. Verum aliquando moderate omnino infeſtat; et maxime, quando circa ſolam cutim diſperſum eſt, minime lædens ſubjectam carnem. Et plerumque tale fit, et illud eſt Exquiſitum Eryſipelas. *Lib.* ii. *Meth. Med. ad Glaucon. cap.* 1. *Charter. Tom. X. p.* 368, 369.

of thoſe affections. For ſoon after the paſſage above cited from Galen, he adds, *That an inflammation, which extends to the ſubjacent fleſh, and does not ariſe entirely from the afflux of a thin humour, is not a ſimple eryſipelas, but a mixed affection from an eryſipelas and a phlegmon: in which ſometimes the proper ſymptoms of an eryſipelas prevail, and then this diſorder is by the more modern phyſicians called a* phlegmonode eryſipelas; *ſometimes thoſe of a phlegmon prevail, and then it is called an* eryſipelatode phlegmon. *But if the ſymptoms of neither of theſe appear to prevail, but ſeem to be equal, the diſorder is ſaid to be a phlegmon and eryſipelas mixed*[d].

Oedema.] The word οἴδημα ſignifies ſimply a *tumour*, as was ſaid in the commentary on §. 112, nº 1. But in proceſs of time this name was underſtood generally to mean a ſoft tumour without pain, and eaſily yielding to the touch, without an alteration in the colour of the ſkin; which tumour generally ariſes from watery humours diſtending the cellular membrane. But the oedema of which we here ſpeak is of a very different nature; being generally denominated *oedema callidum*, to diſtinguiſh it from the former. It was demonſtrated, in the commentary on §. 379, that a true inflammation might ariſe in the arterial veſſels, which, by their minuteneſs, exclude the red and ſerous parts of the blood. A tumour therefore, which is painful, hot, and not red, but yellowiſh, or ſometimes even white, is to be called an *oedema callidum*; which only differs from an eryſipelas, in that the ſeat of the diſorder is placed in much ſmaller veſſels. It is ſometimes alſo called an *eryſipelatous oedema*, inaſmuch as it often nearly approaches an eryſipelas. It is frequently obſerved in the head and face, and is commonly termed the *gutta roſacea*. Some ſigns of this oedema are to be met with in

[d] Quemadmodum id, quod ſubjectam carnem attingit, neque ex tenui omnino fluxione fit, non ſolum eryſipelas eſt, ſed mixtus affectus ex eryſipelate et phlegmone: in quo quandoque propria eryſipelatis ſymptomata prævalent, et a recentioribus medicis voeatur talis affectus eryſipelas phlegmonodes; quandoque autem phlegmones, et dicitur ideo phlegmone eryſipelatodes. Quod ſi neutrius (ſymptomata) evidenter prævalent, ſed æqualia videantur, phlegmonen et eryſipelas mixta eſſe dicuntur. *Ibid.*

in Galen: for though he asserts that any kind of tumour may be called by this name, or rather that it might be more particularly applied to cold tumours properly so called; yet in treating on the cure of an erysipelas, whether simple or compounded with other disorders, he says, *But in the same manner as a phlegmon is often compounded with an erysipelas, so an erysipelas may be sometimes mixed with an oedema; and may be denominated, as being compounded of both, an* oedematous erysipelas [e]. But that he did not understand the case, in which the skin of the parts, distended by a cold tumour, became erysipelatous, is sufficiently evident from what he subjoins in the following chapter, where he says, *But in the same manner as an erysipelas arises from a bilious afflux, so an oedema may arise from phlegm, which is then a soft and indolent tumour. I am indeed not ignorant, that an oedema may also arise in another manner, about the feet, in dropsical disorders, in consumptions, and in other violent depravations of the habit; and in these indeed the oedema is a symptom of the plenitude which oppresses the patient, requiring no particular or distinct treatment,* [f] &c. But although he calls it an *indolent tumour*, from his preconceived opinion that it arose from pituita; yet it is very evident, from the remedies which he recommends for the cure of this oedema, that it was rather of a hot than of a cold disposition: for a little afterwards he adds, *But if the oedema proceeds from the afflux of a phlegmatic humour into the part, the cure will be sometimes fully accomplished only by a sponge which has been moistened with vinegar and water,* [g] &c.

[e] Quemadmodum autem sæpe phlegmonæ admiscetur erysipelas, ita etiam aliquando oedemati: ac vocetur, quod ex ambobus tum est conflatum, Erysipelas Oedematosum. *Ibid. lib.* xiv. *cap.* 3, 4. *Charter. Tom. X.* p. 321.

[f] Quemadmodum autem ex biliosa fluxione erysipelas, ita ex phlegmate fit oedema, rarus quidam ac indolens tumor. Equidem scio aliter quoque oedemata provenire circa pedes in hydropicis affectionibus, phthisibus, aliisque pravis, qui vehementes sunt, habitibus. Atque in illis quidem oedema plenitudinis hominem prementis est symptoma, nullam seorsum propriam curationem requirens, *&c.*

[g] At si ex pituitoso humore in partem influente oedema consistit, abunde aliquando satisfacit spongia sola, quæ ex aqua, in qua sit aceti aliquid, maduerit, &c.

Since therefore this oedema calidum is a true inflammation seated in the smallest lymphatic arteries, there will be always danger in this case, that the thin lymph of the blood may acquire such a cohesive disposition as may render it impervious and apt to obstruct its small vessels; from whence the functions of the brain especially may be disturbed, as they depend on a free circulation of the finer humours through the smallest arteries, whether this disorder be originally formed either in the encephalon, or by a translation from some external part inwards. Add to this, that if the disorder is violent, the smallest vessels being destroyed may incline the parts to a sudden gangrene.

Scirrhus with inflammation.] A scirrhus is a hard and unequal tumour, with little or no pain, seated chiefly in some glandular part. If it be confirmed or inveterate, it consists of such a matter as appears incapable of being dissolved by any remedy or means with which we are as yet acquainted, nor can it ever be separated from the sound parts by a mild suppuration. From whence it is evident how dangerous an inflammation is when seated near a scirrhus, or when fixed in the integuments which invest a scirrhus; since it may then soon degenerate into a cancer, as we shall explain more at large hereafter, when we come to treat professedly on a scirrhus. Galen has very well distinguished the hardness of a scirrhus from the resistance of a phlegmon, when he says, *For a phlegmon is not hard, but occasions a resisting tumour in the same manner as when bladders are filled with any liquor or with air* [h].

§. 381. BUT so often as these causes (375, 376, 377, 378, 379) have produced this stagnation (371, 372, 379) in the small vessels (372, 373, 374, 378, 379,) then the blood moved by the remaining vis vitæ, produces certain effects

[h] Phlegmone namque non duram (σκληρον), sed resistentem tumorem efficit (αντιτυπον) perinde atque utres sunt liquida materia aut aere pleni. *Comment. in textum* 30. *Epidem. Hippoc. lib.* vi. *Charter. Tom. IX. p.* 389.

effects or ſmyptoms, which are at the ſame time the proper ſigns of an inflammation.

Two cauſes are obſerved to occur in every inflammation ſeated in any ſeries of the arteries; namely, An imperviouſneſs of the fluids, occaſioned by a narrowneſs of the veſſel or a concretion of the particles; or, An error of place, and the propelled humours being at the ſame time urged forwards with an increaſed velocity into the impervious veſſels by the vis vitæ acting behind them. If theſe concur, an inflammation is preſent; but if there is only an imperviouſneſs of the fluid, it affords the idea of obſtruction: which laſt is therefore the prediſpoſing or proegumenal cauſe of inflammation, while the procatarctic or acceſſory cauſe is the increaſed motion urging on the back of the obſtruction. But while theſe cauſes act, certain changes are produced in the inflamed part, which, being obſerved, afford the true diagnoſis of a preſent inflammation; but of theſe we are to treat in the following aphoriſm, in which they are enumerated in their proper order.

§. 382. 1. THE minute and ſcarce viſible obſtructed arteries are now enlarged by the diſtending blood, and from hence a red tumour. 2. The arterial lymphatic veſſels, which were before pellucid and inviſible, do alſo ſuffer the ſame diſtenſion and alteration in colour; and from hence an increaſe of the redneſs, and this eſpecially when the very ſmall veſſels and veſicles in the panniculus adipoſus are ſtuffed full of thick blood deprived of its more fluid parts. 3. The ſmall veſſels being ſo far diſtended as to be near upon breaking their ſmalleſt fibres, from hence follows a pricking pain. 4. The ſolids and fluids are both violently compreſſed or compacted together, and from hence a hardneſs and reſiſtance in the part. 5. From an accumulation of the red blood,

blood, which is violently impelled into the veſſels, ariſes a ſhining redneſs. 6. From the reſiſtance, pulſation, compreſſion of the veſſels as yet pervious, but made narrower by the enlargement or dilatation of thoſe which are obſtructed, ariſes a violent attrition of the parts of the juices againſt each other and againſt the ſolids, as alſo of the ſolids againſt them; and from hence follows the heat or burning of the part. 7. Becauſe the blood impelled from the heart does, by the force which it acquires from that muſcle, dilate the ſides and extremities of the obſtructed veſſels; from hence follows a pulſation. 8. From an irritation of the fibres, and a ſwifter courſe of the blood through thoſe veſſels which are open, (ſince it is returned by the veins, but obſtructed in many of the arteries;) ariſe a quick pulſe, fever, thirſt, heat, watchings, weakneſs, and uneaſineſs.

1. It was demonſtrated in the commentaries on §. 120, where we treated of thoſe effects which followed from obſtruction as the cauſe, that the obſtructed veſſels were of neceſſity extended or dilated. For that force, with which the heart propels the blood into the arteries, cauſes their ſides to recede from the axis of the veſſel, ſince they are full, and gradually converge or become narrower. The reſiſtance therefore at the extremities of the arteries, and their fulneſs, are the principal cauſes why they are dilated by the impulſe of the blood: but in obſtructed veſſels there is the greateſt reſiſtance, and at the ſame time the greateſt fulneſs, ſince nothing can be tranſmitted through their extremities; a great dilatation of them muſt therefore of neceſſity follow. If now we alſo conſider, that an inflammation is accompanied with an increaſed motion of the blood, it will evidently appear, that the veſſels muſt be more largely diſtended when there is an inflammation, than when they are barely obſtructed. But when this

his diſtenſion is made in thoſe arteries which naturally onvey the red blood, or which admit it when they are ilated by diſeaſe, it is evident, that the tumour form-d by that diſtenſion muſt appear red: for if an ob-ruction or inflammation is ſeated in the ſmalleſt veſ-els, they may be in the utmoſt diſtenſion which they re capable of bearing without a rupture, and yet may ney exclude the red part of the blood, as we ſaid at §. 379, and §. 380. Nay, this diſorder may be con-eived to reſide in veſſels ſo extremely minute, that e-en the tumour reſulting from their dilatation may be oo ſmall to come under the obſervation of our ſenſes. ut concerning this, ſee more in the commentary on 122. But a true inflammation, properly ſo called, always ſeated in thoſe veſſels, which either naturally ontain the red blood, or which are capable of receiving when dilated, as is evident from the definition given f it at §. 371.

Beſides this, the increaſed heat, which accompanies very inflammation, makes another addition to the bulk f the tumour, as will be preſently demonſtrated at 6; for it appears from certain experiments, that all odies expand throughout all their dimenſions by an ncreaſe of heat.

2. A ſerous artery is derived from the leaſt ſangui-rous artery, in the ſame manner as a branch is deri-ed from its trunk: but the ſides of the ſanguiferous rteries cannot be diſtended without diſtracting and nlarging the orifices of the ſerous arteries which ariſe rom them; from whence the red part of the blood nay enter through their dilated orifices. The ſame alſo true with reſpect to the lymphatic arteries, hich are derived from the ſerous arteries: for that ieſe may be ſo diſtended, as to be capable of receiving ie red part of the blood, is apparent in ophthalmias inflammations in the eyes, as we ſaid a little before. rom hence therefore will manifeſtly follow an increaſe f the redneſs of the tumour. Neither, however, is l this ſeemingly ſufficient to produce ſuch enormous umours as are frequently obſerved in violent inflam-ations. But we demonſtrated in the commentary on §. 374,

§. 374, that an inflammation fixes itself in no part more frequently and firmly than in the fat, when the small vessels of this membrane are stuffed up with impervious blood, and discharged through the dilated orifices of the vessels which open into the cells of the membrane; from whence this adipose membrane, which is so easily dilatable, is often distended in a surprising manner. Galen [a] has very well observed this cause of the tumour in a phlegmon: for after having said, that no tumour can arise without the accession of new matter to the swelled part; or without a dissolution of the parts by the violent heat, so as to pass into air, which might distend the part into a larger bulk, (in the same manner as water, for example, being rarefied by heat into vapours, occupies an immense space); he proves that the tumour in a phlegmon does not arise from this rarefaction of the juices, so as to dissolve them into vapours of air: For (says he) if the part afflicted with a phlegmon be laid open by incision, much blood flows from it; and the whole part seems extremely full of blood, in the same manner as spunges full of water; but no air or spirit is discharged either immediately or any time after. And in the end of the same chapter he adds, That in inflammations, all the parts are filled with blood, transuding through the coats of their vessels, so as to mix like dew with every part of the *flesh* [b]. By *flesh* Galen understands the tunica adiposa, as is evident from what was said in the commentary on §. 374. as also from many other passages in his writings: For in the chapter just mentioned he carefully observes, that a tumour which accompanies an inflammation, is very different from that which arises from an increase of the habit of body; making use of the word πολυσαρκιας, to denote a greater obesity.

But when the red part of the blood enters the smaller dilated vessels, it there mixes both with the serum and thinner lymph contained in those vessels: but then the red part only of the blood remains impervious, being wedged into the narrowest parts of the converging ves-

sels,

[a] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. p. 313.
[b] Ibid. p. 315.

els, while the more fluid parts will be carried off by the lateral veſſels which open betwixt the obſtruction and the preſſure which urges behind; and from hence the red part only will be more and more accumulated in the obſtructing veſſel, which will again prove another cauſe increaſing the redneſs in the inflamed part.

3. Since therefore the veſſels are diſtended by the impulſe of the humours urged on behind the obſtructing matter, from hence their coats, and conſequently the nervous fibres diſperſed through them, will be diſtracted; which will excite pain, as is evident from what has been ſaid in the commentaries on §. 220. and §. 224, n° 2. But ſince the largeſt veſſels which are interpoſed betwixt the ſanguiferous and the ſmalleſt arteries (namely, the ſmalleſt extremities of the arteries which convey the red blood) do not equal in thickneſs the tenth part of a hair of the head, it is evident, that the diſtraction of the nervous fibrillæ diſperſed through the coats of ſuch a ſmall veſſel, muſt excite a pain as if in a ſingle point of the body only; and from hence the pain is ſaid to be pricking. But one of theſe ſmalleſt ſanguiferous arteries is yet much larger than either the ſerous or lymphatic; though even in theſe, there is a like diſtraction and pain produced in a point ſtill leſs. So that a hundred of theſe ſmall veſſels being inflamed, will cauſe a pain as if it was fixed in a ſingle point; only becauſe the impulſe of the humours behind the obſtruction ſo diſtends the vaſcules, that the nervous fibres conſtituting their ſides are in danger of breaking. And from hence it is, that when ſo much blood is drawn from a vein in a violent pleuriſy that the patient faints away, the pain either entirely vaniſhes, or at leaſt is much diminiſhed.

4. Our blood, when at reſt, ſeparates into two parts; the one a red concrete, and the other a watery ſerum in which the red part ſwims. But there are two principal cauſes in the body which prevent this concretion: namely, A continual motion; and, The interpoſition of a thinner fluid betwixt the red globules, by which they are removed from their mutual contacts. But when this red part of the blood ſtagnates in any of the

ſanguiferous veſſels, or becomes impervious in any o the ſmaller dilated veſſels, its more fluid parts are ex preſſed, (as we ſaid before at no 2. under the preſen aphoriſm :) from whence follows a compreſſure, and combination of the red globules with each other; and as they are flexible, their ſpherical figure will be flat tened, and they will touch one another in more points and by that means begin to cohere more ſtrongly These cauſes therefore continuing, the red globule will be accumulated in the much diſtended veſſels, a alſo in the cells of the tunica adipoſa; and from hence a greater hardneſs and reſiſtance of the inflamed part will neceſſarily follow. But as veſſels thus diſtended compreſs thoſe which lie next to them, the capacities of theſe laſt being thus diminiſhed will propagate the diſorder through the whole inflamed part. For this reaſon Hippocrates often places hardneſs and pain fo an inflammation. Thus in his prognoſtics [c], in treating on an inflammation of the bladder, and the conſequences which thence follow, he ſays, κυσιες ὁ οκληραι τε κ επωδυναι, *At veſicæ duræ et dolentes, &c.* And in other places, as Hollerius [d] remarks, he diſtinguiſhes a phlegmon from other tumours by the hardneſs and pain.

5. The thinner parts of the juices being expreſſed, leave only the red parts of the blood accumulated in the diſtended veſſels; whence (*cæteris paribus*) the redneſs is alſo much the greater, in proportion as the inflammation is more violent. But the ſkin being in moſt parts of the body looſe and moveable, is very much diſtended by the impervious blood ſtagnating in the adipoſe membrane, inſomuch that it ſhines with a ſmooth ſurface; hence obeſe people are ſaid to ſhine, having their ſkin diſtended by the accumulated fat. Thus the well-fed dog was aſked by the lean wolf, from whence he ſhined with that fatneſs [e]. And we daily obſerve, that the tenſe ſkin looks beautifully ſmooth and ſhining in young people, whereas in old age it is beſet with ugly wrinkles.

6. We are aſſured from certain experiments, that the

[c] Sentent. 71. Charter. Tom. VIII. p. 659. [d] Comment. in Coac. Prænot. Hippoc. p. 552. [e] Phædr. iii. 7.

the moſt intenſe heat may ariſe barely from the attrition of bodies againſt each other, and even that actual fire may be by this way produced. It has been alſo proved, that the heat ariſing from this attrition is ſo much the greater in proportion as the bodies are more rigid and elaſtic; and alſo that it increaſes in proportion as the bodies are more forcibly preſſed againſt each other, and as they are more ſwiftly agitated [f]. But it is certain, that water or any other liquor being interpoſed between the bodies while they are rubbed againſt each other, prevents the heat from becoming ſo intenſe as it would were there no ſuch liquor interpoſed; from whence it would ſeem, that heat cannot eaſily ariſe from the attrition of our fluids againſt the ſides of their containing veſſels. But if we conſider that the globules of the blood are elaſtic, and alſo moved very ſwiftly through elaſtic veſſels, which converge in ſuch a manner, that, in the ultimate extremities of the ſanguiferous arteries, hardly more than a ſingle globule can paſs through at a time; and that therefore, the more thin parts of the juices being carried off by the lateral branches, the largeſt globules will be ſtrongly preſſed and rubbed againſt the ſides of the veſſels; it is ſufficiently evident, that heat muſt ariſe from this attrition. Hence, in ſtrong people who have a thick blood, a greater heat is uſually obſerved: But when the blood, being diſſolved, inclines more to the nature of inelaſtic water, the heat is always obſerved leſs. For the ſame reaſon, too, a greater heat always accompanies a ſwifter motion of the blood through its veſſels. Nor is it any objection to this, that the impervious blood *ſtagnates* in the obſtructed veſſels of the inflamed part; ſince it appears from the experiment of Lewenhoek, alledged in the commentary on §. 132. that ſuch impervious particles of the blood are repelled back by the contraction of the artery at the inſtant when the heart does not act, and that ſoon after they are again propelled to the obſtructed part of the artery while the blood is ſent forward by the ſyſtole of the heart; whence it is evident, that thus the

[f] Videatur de his omnibus Boerhaavii Chem. Tom. I. p. 176, &c.

obſtructing particles may run forwards and backwards in the ſame veſſel. Since, now, it appears, from what has been ſaid before, that the thinner juices are continually expreſſed, while the groſs and impervious particles of the blood are accumulated and condenſed, while alſo the velocity of the blood's motion is augmented through the inflamed part, the reaſon will be evident, why ſuch a conſiderable increaſe of heat muſt neceſſarily follow. But the adjacent veſſels which are not yet obſtructed, will be compreſſed and made narrower by the diſtenſion of the inflamed veſſels; whence will follow a greater attrition of the compreſſed veſſels, partly from a diminution of their capacity, and partly from the increaſed velocity of the fluids to be tranſmitted: For if out of an hundred veſſels, fifty of them are obſtructed, the blood muſt then paſs as ſwift again through the fifty which remain pervious. In an inflammation, therefore, every circumſtance concurs from which we are aſſured by experiment a greater heat may ariſe: For the blood, being deprived of its more fluid parts, concretes almoſt into a ſolid maſs, which is every moment condenſed more and more by the violent action of the veſſels and the impulſe of the humours acting behind; the veſſels compreſſed by thoſe which are diſtended, will be applied more ſtrongly to their contained humours; and the motion of the fluids through the veſſels will be in general accelerated. From hence the reaſon appears, why an inflammation does, by the ſimilitude of its cauſes and effects, derive its name from fire, as was ſaid before at §. 370.

7. Since the whole body is found, by the modern anatomy, to contain arteries diſperſed throughout almoſt every point of it; and that all theſe arteries are dilated at one inſtant of time while the heart is in its contraction, and that they are again contracted the moment following while the heart is in its dilatation; it will be evident, that almoſt every point of the body receives a motion of pulſation every moment of life. But we do not naturally take any notice of this motion even though it is very ſtrong, and always performed in our bodies by the ſame laws: but ſo ſoon as this motion

motion exceeds its uſual bounds, we preſently perceive it. Thus the ſtrong pulſation of the heart, which may be ſo eaſily perceived by applying the hand to the breaſt, is not at all felt by a perſon in health; but ſo ſoon as it exceeds its due degree, by paſſions of the mind, a violent motion of the body, *&c.* then the heart is perceived immediately to palpitate. It is no wonder, therefore, that a pulſation ſhould be perceived in the inflamed part, which was not obſerved in it before. For the blood thrown into the obſtructed arteries by the force of the heart, will ſpend all its force in removing the ſides and extremities of thoſe arteries; and from thence the ſides of the arteries will recede farther from their axis: and when the force of the heart ceaſes, they will return or contract again with ſo much a greater force, in proportion as they were more diſtended. The pulſe will be therefore thus increaſed in the inflamed part; and being raiſed in ſtrength and velocity beyond its natural action, it will be very diſtinctly perceived.

8. When the ends of the arteries are obſtructed, the humours contained in the veins correſponding to thoſe arteries do nevertheleſs return to the heart; but being afterwards propelled by the heart, they cannot paſs through the obſtructed arteries, but muſt run with ſo much a greater velocity through thoſe arteries which remain pervious. For, in this caſe, the quantity of humours to be tranſmitted through the veſſels is not diminiſhed, though there is a leſs number of the pervious or tranſmitting veſſels; from whence it is ſufficiently evident, that the blood muſt paſs with an increaſed velocity through the other veſſels which remain pervious. But, at the ſame time, it is alſo from hence apparent, that this cauſe will not be ſufficient to increaſe the velocity of the humours, ſo as to render it ſenſible to the phyſician, unleſs the affected part is ſo large, that the number of its impervious veſſels will make a conſiderable difference when compared with thoſe that remain open: for if a thouſandth part of the arteries are thus obſtructed by an inflammation, the increaſed velocity required to move the blood through the reſt of

the open veſſels ſeems to be ſcarce within the reach of obſervation. Another cauſe is therefore neceſſary to account for the frequent attendance or following of a fever after an inflammation; which fever we frequently obſerve, even when the inflammation is ſeated in but a very ſmall part of the body: for thus a very violent fever often attends, when an inflammation is ſeated in but a very ſmall membrane; as, for inſtance, in the paronychia or whitlow. Therefore it is added in the text, *From an irritation of the fibres.* When we treated of the effects of pain, in the commentary on §. 226. it was demonſtrated, that a fever might ariſe from pain only; and for the ſame reaſon a violent fever ſo frequently accompanies the moſt painful inflammations, whereas in inflammations that are not very painful a fever ſeldom attends: Whence it follows, that the fever ſeems to ariſe chiefly from the irritation of the nervous fibres diſperſed through the inflamed veſſels and membranes, which are too violently ſtretched or preſſed. That there is in reality ſuch a diſpoſition in our veſſels as renders them liable to irritation, whereby the circulation of their humours is accelerated, we are taught by many obſervations. When the offending matter is diſſolved in acute diſeaſes, it flows through the veſſels, and is often tranſlated or ſettled upon ſome other part, or elſe it is diſcharged from the body by critical evacuations; and in theſe changes, what wonderful diſturbances frequently ariſe in the body! and in what a ſurpriſing manner is the pulſe often accelerated and diſcompoſed! When the chyle, which is made from too large a quantity of aliments, or from ſuch as are more compact or acrimonious than uſual, comes to circulate with the blood through the veſſels, it produces a fever: but of this we ſhall treat hereafter, in the hiſtory of fevers; and it may be at preſent ſufficient for us only to obſerve this in general, in order to ſhew that an irritation of the fibres may produce a fever.

But the ſigns of a fever attending, are the appearance of its chief ſymptoms, thirſt, heat, watchings, *&c.* of which we ſhall treat particularly in their proper places.

But

But it is to be obſerved, that theſe ſymptoms do not attend every inflammation, but only when the whole maſs of blood has acquired ſuch an inflammatory ſpiſſitude that it cannot eaſily paſs through the ſmalleſt veſſels. For it appeared before, that in healthy blood there is naturally an inclination to concretion, and the more as the patient was of a ſtronger habit. But ſo long as this tendency to concretion can be overcome by the action of the veſſels in the viſcera, ſo long will the patient ſurvive. But we ſee daily, that, in acute diſeaſes, the blood is ſo much altered, that at length it ſcarce retains it fluidity; it immediately congealing, if not prevented by the frequent action or attrition of the veſſels. Thus the blood which drops from the noſe in ardent fevers immediately congeals into a ſolid maſs; inſomuch that often this thick blood ſtops up the ſmall arteries which were opened by nature to make a ſalutary diſcharge, in order to terminate the diſeaſe. Hence Hippocrates [g] juſtly condemns theſe ſmall diſcharges of blood, in his Prænotiones Coacæ; and in another place [h], he gives inſtances of three patients, proving the fatal event, when this diſcharge of blood from the noſe was very ſmall on the fourth and fifth day. When therefore this inclination of the blood to concretion is augmented, it is ſufficiently apparent, that it will meet with more difficulty in paſſing through the ſmalleſt arteries; from whence will ariſe a greater reſiſtance to the heart: and ſince the lungs ought to receive and tranſmit the blood, which it immediately receives from the right ventricle of the heart through the ſmalleſt extremities of its pulmonary artery; therefore the leaſt inclination of the blood to run into cohesions will be perceived in the lungs; whence again the reſpiration will be increaſed, in order to protrude the blood more forcibly through the lungs. Thus ariſes that uneaſineſs or anxiety, which is a bad ſign in all acute diſeaſes, and eſpecially in the inflammatory; that is, the reſpiration becomes laborious and difficult, and the patient declares his anxiety and uneaſineſs by continually changing the poſture of his body. This is the δυσπνοια,

[g] N° 59. [h] Epidem. i. textu 63. Charter. Tom. IX. p. 63.

or *hesitation* of the blood, as it is called by Hippocrates, which though it may be the consequence of other causes (as will be hereafter declared in §. 631 *et seq.*) does yet more frequently proceed from an imperviousness of the blood.

It is therefore evident, from all that has been said under this aphorism, that a phlegmon is known by these signs, to be a red tumour, tense and shining, with a pricking pain, heat, and pulsation, accompanied with a fever, either in the whole, or at least in that particular part of the body.

§. 383. AND this is the state (382) of a phlegmon before the disorder has arrived to its full height.

All the signs enumerated under the preceding aphorism are observed in a phlegmon which is increasing, but has not yet arrived to its full height: for there are three stages observed by physicians in all diseases; namely, their increase, height or state, and their declension. Their increase is said to be as long as all their symptoms grow worse; the state or height of the disorder, is, when the symptoms are arrived to their greatest degree of malignity, and do not afford any sensible signs of their augmenting or diminishing; and the declension of the disorder is when the violence and number of the symptoms gradually diminish. Thus, when a phlegmon has arrived to its full height, it begins to be disposed to terminate either by resolution, which we call health; or in some other disease, as an abscess by suppuration, a gangrene, a sphacelus, a scirrhus, *&c.* as we shall presently declare more at large. But at the time of change, many of the signs or appearances which accompanied the phlegmon as not yet adult, are considerably altered, or else removed; and other new signs appear, which were not to be observed before: Thus, for instance, the redness, tension, pain, and hardness, which are observed in a phlegmon, begin to diminish when it tends to a gangrene; and at length they even quite vanish; and are, on the contrary,

trary, ſucceeded by an inſenſibility of pain, a pale aſh or brown colour, flaccidity, puſtules full of ichor, *&c.* Theſe ſtages are therefore to be carefully diſtinguiſhed, as well in a phlegmon, as in other diſeaſes, in order to determine any thing with certainty in relation to the diagnoſis, prognoſis, and curative indications.

§. 384. IF now blood be drawn, in a full ſtream, from a large orifice in a vein, into a baſon; as it grows cold, it forms a white, hard, thick, and tough ſkin, almoſt like the ſkin of pork.

When blood is drawn from a perſon who has a violent inflammation, it affords an appearance ſurpriſing enough. It is well known, that the blood congeals ſome time after it has been received from the vein and ſtood ſtill in a baſon; and that it then ſeparates into two parts; the one a thin yellow-coloured liquor; and the other a red concrete, uſually ſwimming in the former; which laſt is uſually termed the *craſſamentum*. But in acute, and moſt of the inflammatory diſeaſes, the upper ſurface of the craſſamentum appears covered with a white or light bluiſh coloured ſkin, which is frequently ſeveral lines thick; and is ſometimes ſo tough, and firmly adhering to the craſſamentum, that it with difficulty admits of being divided, even by a raſor. As this tough ſkin is almoſt conſtantly obſerved in the blood of thoſe who are afflicted with a pleuriſy; therefore phyſicians, when they ſee the ſame appearance in the blood extracted in other diſeaſes, term it *pleuritic blood*, though it is not reſtrained to a pleuriſy only. There are ſeveral very ſurpriſing obſervations to be met with in authors concerning this appearance. Thus Sydenham [a] has remarked, that if the blood does not flow in a direct or horizontal ſtream, but runs trickling down over the ſkin, that then this tough cruſt will not appear on the ſurface of the blood, even tho' it flowed faſt enough from the orifice; and he ingenuouſly confeſſes himſelf ignorant of the cauſe of this difference. He has alſo obſerved, that the patient is not

[a] De Pleuritide, p. 333, 334.

not relieved by that manner of bleeding as he is when the blood runs in a full ſtream, and appears covered with this cruſt; and he takes notice, that any other obſtacle which impedes the free exit of the blood from the orifice of the vein, will alſo hinder the generation of this cruſt or ſkin, and occaſion the patient to be leſs relieved by it. But what is ſtill more wonderful, it has been obſerved that this ſkin will not be formed, even though the blood has been drawn in a full ſtream from the vein, provided it is but ſtirred round with the finger. Therefore the origin of this cruſt appearing on the ſurface of the venous blood, ſeems to be very obſcure. Is it produced from the ſerum of the blood, inclined by diſeaſe to a greater degree of coheſion? But this may be queſtioned; as it is certain that it always occupies the ſurface or upper part of the craſſamentum, which ſwims in the ſerum. Or is it formed of the crude chyle, not yet converted into the blood? This is the opinion of the acute Simſon [b]; but it ſeems to be liable to this objection, That the chyle mixed with, and not yet converted into, the blood, muſt ſwim in the ſerum, and not cohere to the craſſamentum. The ſame author obſerves, that if a ſtrict ligature be made about the arm or thigh, and a vein be opened three or four hours afterwards, ſo as to let the blood flow out in a full ſtream, that then this ſkin will always appear; as it is alſo conſtantly found in the blood of women with child. Whence he places the cauſe of it in the remora or ſtagnation which the blood ſuffers in the veſſels, obſtructed ſome time by ligatures, or by the preſſure of the uterus in gravid women; or at leaſt becauſe it is moved more ſlowly. To ſpeak the truth, I muſt confeſs myſelf in a doubt what to think concerning this tough ſkin, which always moſt firmly adheres to the ſurface of the craſſamentum. It is the opinion of many learned and eminent phyſicians, that it is formed while the blood is more inſpiſſated and inclined to concretion by an increaſed velocity of its motion; and therefore they judge it to be rather an effect or conſequence, than a prediſpoſing cauſe, of the diſeaſe. But I have fre-

[b] De Re Medica Diſſert. quatuor, p. 112.

frequently obſerved, that ſuch a cruſt has appeared in the blood of the moſt healthy people, who open a vein every year in the ſpring; and even in a weak man, who bled every three months to prevent an hæmoptoë: in which caſes there was therefore ſuch a diſpoſition of the blood, even tho' there was no inflammation; and on the contrary, no ſuch cruſt has been obſerved in ſome of the moſt violent inflammatory diſeaſes, which has then been always received as a very bad ſign.

§. 385. THE diſorder increaſing, all theſe ſymptoms (382, 383, 384) continue, but in a greater degree; and in the mean time the expreſſed lymph is carried off, and the red blood more inſpiſſated.

All the ſymptoms which have been hitherto conſidered, aroſe from the heſitation of the impervious blood in the ſmalleſt extremities of the converging arteries, and from the impetus of the blood more forcibly impelled behind, and urging on the back of theſe obſtructions. If therefore the tenacity of the obſtructing matter is increaſed, or takes place in more of the ſmall veſſels, while the impulſe of the blood urging behind is alſo augmented; it is very evident, that then all the ſymptoms muſt be increaſed. From hence a greater tumour of the inflamed parts; with a colour inclining towards purple, by reaſon of the extreme redneſs; a burning heat; intenſe pain, from the diſtracted fibres being almoſt upon the point of breaking; with an extreme tenſity or ſhining of the part, &c. And ſince the blood cannot paſs through the obſtructed veſſels, into which it is propelled, the thinner parts will go off by the lateral veſſels: the red part will remain alone impervious, and will be applied and compacted againſt the obſtructing matter by the force of the blood urging behind; from whence the quantity of obſtructing matter will be continually increaſing, and therefore its removal will become the more difficult.

§. 386. IF the circulating humour is mild or not acrid,

acrid, its motion ſedate or not exceſſive, and the obſtructing cauſe not too violent, the obſtruction itſelf alſo but ſmall, and ſeated either in the ſanguiferous or in the beginning of the lymphatic arteries; then the obſtructing matter concreted by ſtagnation being reduced to a ſtate of fluidity by the mobility of the veſſels and a diluting vehicle, the inflammation terminates by *reſolution* or *diſperſion*.

Every diſeaſe terminates either in health, in another diſorder, or in death; which is a general rule that takes place likewiſe in inflammations, and therefore we are next to conſider the various ways in which they terminate. When the inflammation is ſo diſperſed, that nothing of the diſorder remains, and all the parts are reſtored to the functions which they formerly performed in health, without any other diſorder following, it is then ſaid to be *cured*. But if the inflammation turns to a ſuppuration, the firſt diſorder is indeed removed, but then another comes in its place; namely, an *abſceſs*. The ſame is alſo true if the inflammation turns to a ſcirrhus. But when a moſt violent inflammation totally intercepts the vital influx and efflux of the humours to and from the affected parts, in that caſe the inflammation indeed ceaſes, but is followed with a *gangrene* firſt, and then with a *ſphacelus*, which laſt is a true mortification or death of the part.

Of all the ways therefore of terminating an inflammation, the moſt deſirable is that which phyſicians call a *reſolution* or *diſperſion*. That is, when the impervious matter, heſitating in the obſtructed veſſels, is by the remaining vis vitæ and the uſe of proper remedies ſo diſſolved, or the veſſels in which it is ſeated ſo diſpoſed, as to let that impervious matter paſs into the veins, or elſe be repelled back into the larger veſſels: ſo that thus a free circulation of the humours is reſtored through the veſſels before impervious, without injuring their continuity; and the concreted fluid being now diſſolved, and mixed with the circulating humours, may paſs freely

freely through thoſe narrow extremities of the veſſels which it ought to pervade agreeable to the laws of health. And when this takes place, the inflammation is ſaid to be cured by a reſolution.

It therefore remains for us to inquire into thoſe ſigns which denote that this reſolution is practicable; and all theſe we find enumerated in this aphoriſm. For the treatment is required to be very different, when it ſhall appear that the inflammation will terminate in a different manner from that above mentioned, as will appear evidently from the enſuing paragraphs.

If the circulating humour is mild.] All our healthy juices (except perhaps the bile, and thoſe which are excrementitious) are ſo mild and inoffenſive, that they do not excite pain, even though they touch the eye, or a naked nerve in a recent wound: and this was neceſſary, that they might paſs with a pretty ſtrong impulſe in a healthy ſtate through their very tender veſſels, and yet not injure them. Since therefore the reſolution of an inflammation ſuppoſes a motion of the ſtagnating humour, and a reſtitution of its concreted parts to their former fluidity, without any deſtruction of the veſſels; it is very evident, that in this caſe they can have no conſiderable acrimony. For when the blood is forcibly impelled by the heart into the obſtructed veſſels, it is then preſſed back again by the contraction of thoſe veſſels while the heart is in its diaſtole; by which means the ſides of the veſſels will ſuffer a conſiderable attrition from the humours, ſo that if they contained acrimonious particles, it is evident that theſe tender ſmall veſſels would be diſſolved and deſtroyed. This is the reaſon why, in ſcorbutical patients, the ſlighteſt inflammation ariſing in the legs, even from external cauſes, can hardly ever be cured by a reſolution, but almoſt conſtantly degenerates into an ulcer; and the ſame is alſo obſerved in all other ill habits of body, in which the juices are infected with an acrimony.

Its motion ſedate.] It was demonſtrated in the commentary on §. 120, that when an obſtruction is formed, the obſtructed veſſel is diſtended, dilated, and rendered thinner, by the impulſe of the fluids; ſo that it

it at length burſts aſunder. But in that caſe the humours had no greater velocity than is uſual in an healthy ſtate; and it is very evident, that if the impulſe of humours in the obſtructed veſſels is increaſed, the ſolution of their continuity will be more ſpeedily effected. But in order to diſperſe or reſolve an inflammation, it is required to preſerve the continuity of the veſſels; and therefore, when an inflammation is accompanied with the moſt violent motion of the humours, there can be no hopes of a reſolution.

The obſtructing cauſe not too violent or confirmed.] An increaſed motion of the humours is prejudicial, not only as it may break the continuity of the obſtructed veſſels, but alſo becauſe it compacts the obſtructed particles together with a greater force. But to diſperſe an inflammation, it is required to reſolve the obſtructing concrete into thoſe ſmall particles by the combination of which the obſtruction is formed: but the more the thinner humours which prevent the mutual contacts of the groſſer particles are diſperſed; ſo much the more ſtrongly will theſe laſt be united and preſſed together, the more firmly will they cohere, and the more difficult will it be to diſſolve them again. But when the velocity of the circulation is increaſed, the thinner humours are diſſipated, and the groſſer compacted together, as we demonſtrated in the commentary on §. 100, and at the ſame time the compacting cauſes, which drive the impervious particles cloſe to each other in the obſtructed veſſel, are oftener applied in a given time. Hence appears the reaſon why the moſt ſkilful phyſicians deſpair of a reſolution in a pleuriſy and ſuch like diſeaſes, in which a moſt violent fever has attended for above twelve hours time; and rather direct all their curative intentions to promote the concoction and excretion of the inflammatory matter.

The obſtruction ſmall, and ſeated either in the ſanguiferous or in the beginning of the lymphatic arteries.] An obſtruction is ſaid to be ſmall, either with regard to the part of the veſſel which it occupies, or elſe becauſe it takes place in but a few veſſels of the part affected. Thus for example, if a red globule ſtagnates

nates in the beginning of a dilated ſerous veſſel, that obſtruction may be more eaſily removed than if the globule penetrated to the ſmalleſt extremity of that veſſel. Again, if the greater number of veſſels in any part of the body are obſtructed, each of theſe being dilated will compreſs and ſtraiten thoſe which are adjacent; whence the reſolution of ſuch an obſtruction will always become the more difficult. But an inflammation may be diſperſed moſt eaſily of all, when *(cæteris paribus)* the diſorder is ſeated only in the larger veſſels: for the efficacy of bleeding, and of moſt of the other remedies for inflammations, is exerted chiefly in the larger veſſels. Thus, for example, if thered part of the blood ſtagnates in the ſmalleſt extremities of a ſanguiferous artery, or has entered into the ſerous veſſels by error of place, or elſe into the lymphatics which are of the next magnitude to the ſerous veſſels; it is evident that the obſtructing matter ought to be ſo attenuated or diſſolved, or the obſtructed veſſels ſo relaxed as to afford a paſſage; or, laſtly, the obſtructing matter muſt be repelled back from the ſmaller to the larger capacity of the veſſel. Now, a red globule readily diſſolves into the ſerous globules of which it is compoſed, according to the obſervations of Leeuwenhoeck; and thus likewiſe may the ſerous globules diſſolve into the ſmaller lymphatic ones: therefore ſuch an obſtruction, ſeated in the ſanguiferous or in the beginning of the ſerous and lymphatic arteries, may be thus terminated or reſolved. But if a red globule ſhould have entered veſſels much ſmaller than theſe, it would not be capable of paſſing through its ſmaller extremities, even though it was to be reſolved into ſerous or lymphatic globules; from whence the difficulty of reſolving the inflammation in this caſe is ſufficiently evident. Another means of the greateſt efficacy in the reſolution of inflammations, is the diminution of the quantity and impulſe of the humours urging on the back of the obſtructions, made by a plentiful bleeding, that the obſtructing matter may be repelled by the natural contraction of the veſſels from their narrower to their larger capacities, (ſee §. 141.) This repulſion depends upon the re-action of the veſſel

when the cauſe of its diſtenſion ceaſes: therefore it will take place the moſt effectually in the largeſt veſſels, which have the ſtrongeſt and moſt elaſtic membranes or coats; whereas little good can be from hence expected, when the obſtruction is ſeated in the ſmalleſt and moſt tender vaſcules. From hence therefore the reaſon is evident, why it is neceſſary, in order to cure the inflammation by a reſolution or diſperſion, that the obſtructing matter be not ſeated in the ſmalleſt veſſels. This is confirmed by many practical obſervations; and is moſt apparently demonſtrated in an ophthalmia, in which diſorder we may very plainly perceive the inflamed veſſels of the eyes. For as long as the veſſels of the tunica adnata only appear, and there is no apparent defect in the pellucid cornea, there are great hopes of obtaining a perfect reſolution without any defect remaining: but when the very minute and pellucid vaſcules of the cornea are dilated ſo as to admit the groſſer humours, the inflammation can never be ſo entirely diſperſed, but either a ſuppuration or opake ſpot will be left in the cornea, which will ſometimes disfigure the eye as long as the patient lives.

The veſſels moveable.] For the maintenance of health, it is required that our veſſels yield to the impulſe of the fluids, and again return to their former diameter when the diſtending cauſe ceaſes; and this is called the *mobility* of the veſſels. Now there are two different and even oppoſite cauſes, which diminiſh, and even ſometimes totally deſtroy, the due mobility of our veſſels: the one, When their ſides or coats are ſo much relaxed, that they very eaſily give way to the humour impelled by the heart; but have ſo ſmall a degree of ſtrength or elaſticity, that, when the heart ceaſes to act, their force is not ſufficient to propel forwards their contained blood: the other, When, on the contrary, the ſides of the veſſels are ſo rigid, as ſcarcely to ſuffer them to be dilated at all by the impulſe of the humours. The firſt of theſe defects is therefore a too great weakneſs, and the latter a too great ſtrength of the veſſels. When the veſſels are too weak, they may be ſo dilated, even by a ſmall force, as to admit

admit the groſſer parts of the blood to miſtake their courſe; but then, as they eaſily give way in this caſe, their ultimate extremities may be ſo dilated, as to readily tranſmit the groſſer obſtructing parts of the blood into the veins: whence it will be no great difficulty to remove the obſtruction. To which add, that in this caſe the motion of the humours is always languid, and the fluids are never denſe or compact for want of ſtrength in their veſſels; whence it readily appears, that inflammations ſeldom ariſe in ſuch habits, and that there is no great difficulty in curing them when they do ariſe. On the other hand, when there is too great a ſtrength in the veſſels, the blood is always compact or denſe, and deprived of its more fluid parts, which will cauſe the more groſs parts to unite, and render the inflammation difficult to remove when it is once formed; and this partly from the thickneſs and impervioufneſs of the humours, and partly from the greater ſtrength or contractile power of the obſtructed veſſels, by which they reſiſt dilatation, and more ſtrongly confine the obſtructing particles. This is daily obſerved in practice, where acute or inflammatory diſeaſes in women or children are often eaſily cured by a mild reſolution; but very ſeldom in adults, and thoſe who have been inured to hard labour. The ſame has been alſo obſerved by Hippocrates, who ſays, That ſtrong bodies uſed to exerciſe periſh ſooner by pleuritic and peripneumonic diſeaſes than thoſe who are not uſed to exerciſe [a].

Diluting vehicle or juices.] When the moſt fluid parts of the blood are diſſipated in the beginning of acute diſeaſes, either by ſweats, a diarrhœa, or any other evacuation, there is always great danger of a fatal event. For the groſſeſt particles of the blood are not prevented from concreting or touching each other, but by the interpoſition of the more thin humours.

When blood is drawn from an healthy perſon, it appears an uniform fluid: but, by ſtanding it, reſolves into two diſtinct parts; for the red globules unite and cohere, while the ſerum ſeparates from thence. But

[a] Coac. Prænot. 398. Charter. Tom. VIII. p. 875.

if blood newly drawn be ſtirred about with a ſtick till it is cold, the ſeparation of the ſerous from the red parts of that blood will be prevented, and the whole maſs will remain a fluid; from whence it appears how neceſſary a thin diluent liquor is to prevent a concretion of the blood. For this reaſon Hippocrates condemns a waſting of the more fluid parts of the blood by ſweats, a diarrhœa, *&c.* in the beginning of acute diſeaſes: for he ſays, That a profuſe ſweat ariſing in acute fevers, is bad [b]; and, That a profuſe diarrhœa is fatal in an ardent fever [c]. It is alſo remarked by Sydenham [d], (who ſo diligently attended to the endeavours of nature in the cure of diſeaſes,) that if the patient is infeſted with profuſe ſweats in the beginning of the ſmall-pox, all the ſymptoms are conſtantly augmented or rendered more violent.

If all or moſt of the circumſtances before enumerated, attend an inflammation, there is reaſon to hope it may be diſperſed without incurring any defect or morbid alteration: but this is not by diſcharging the morbid matter, nor by deſtroying the veſſels; but by opening the obſtructed veſſels, and rendering the impervious matter more fluid. But if ſome of the conditions before mentioned as neceſſary to a reſolution be abſent, we are then to endeavour to ſupply their deficiency by art. The humours are to be rendered mild by a ſoftening diet and medicines: the too great velocity of the circulation is to be quieted by bleeding, reſt, a cool air, *&c.* the veſſels of the affected part are to be relaxed by applying fomentations, that they may give way more eaſily to the obſtructing matter: and a diluting vehicle is to be ſupplied by a thin and watery drink; avoiding every thing at the ſame time which tends to drain off the moſt fluid part of the humours from the body. But of all theſe we ſhall ſpeak more largely in the cure of an inflammation.

§. 387. IF the circulating humour is mild, its motion rapid, the obſtruction great and incapable of reſolution (386); then the ſymptoms increaſing

[b] Prorrhet. lib. i. nº 57. Charter. Tom. XII. p. 740. [c] Coac. Prænot. nº 130. [d] Sydenham, Opuſc. Univerſa, p. 321.

creasing (382, 384, 385), the distended vessels break, with pain, heat, pulsation, and tumour; they extravasate their contained humours, which are then dissolved and gently putrefied, and do themselves break off and dissolve the adjacent solids, which, mixing with the fluids, form a similar, white, thick, glutinous, and unctuous humour, called *pus* or *matter*: And this, which is termed *suppuration*, is the second way in which an inflammation is often terminated.

When the obstructing particles are so firmly compacted in the extremities of the converging vessels, that there is no passage afforded for the diluting vehicle to dissolve and carry them into the veins; the increased motion of the fluids, acting behind, still continues to force the obstructing particles further into the more narrow parts of the vessels; from whence it is evident, that at length the impervious matter will be most violently compressed, and continue to stagnate without the least motion in the obstructed vessel, from the narrowest part of which it cannot be repelled towards the broader basis. Therefore the whole length of this inflamed vessel will be quite destitute of the vital influx of the humours, and hence it will be necessary for it to separate from the other living and sound parts. Now we are assured, from a diligent attention to nature in the cure of diseases, that a suppuration separates every part which was destroyed by the inflammation, from those which are living and sound: from whence it is evident, that a suppuration is not so much to be feared, except in those parts of the body, whose continuity is absolutely necessary for the maintenance of life and health; as for instance, in the encephalon; or in a part where the matter cannot be safely extracted, as in a pleurisy, *etc.* But in what manner all those parts, which have been rendered unfit for receiving the vital motion of the fluids, are separated by suppuration, may very well appear from what has been said of this subject in the History of Wounds; where we enumerated all those appear-

ances which are obſerved in an healthy body in every wound, from its firſt infliction to the completion of its cure, (ſee the commentary on §. 158.) For, in the firſt place, the blood is extravaſated from the wounded veſſels; whoſe orifices contracting, then diſcharge only a thin and reddiſh ichor: the ſurface of the wound now appears almoſt dry, and a true inflammation ariſes from the vital motion of the humours urging againſt the obſtructed ends of the veſſels, as is evident from the pain, heat, redneſs, tumour, ſlight fever, thirſt, *&c.* In the next place, the extremities of the impervious veſſels ſeparate, together with part of the impaſſable fluid impacted in the extremities of thoſe veſſels; whence ariſes a viſcid, white, and unctuous fluid, called *pus* or *matter*, upon the ſurface of the wound; and after a careful abſterſion of this matter, the whole ſurface of the wound appears evenly moiſt, which is an evident ſign that the veſſels, which were before obſtructed, are now opened by a ſeparation of their impervious and contracted extremities. A ſuppuration is therefore that ſalutary endeavour of nature, by which ſhe ſeparates from the other ſound and living parts every thing which is become unfit for receiving the vital circulation. Hence Hippocrates well obſerves, (ſee the paſſage cited §. 158, n° 7. and §. 323.) that a wound inflicted by a ſharp inſtrument may be cured without ſuppuration; but that contuſed and diſſected fleſh muſt putrefy or waſte away by turning into matter. But although he here uſes the word *putrefy* when he treats of a ſuppuration, we are not therefore to underſtand ſuch a putrefaction as happens in a dead body, but a different kind of degeneration in the humours made by the life remaining. This has been very well diſtinguiſhed by Galen, where he treats of fevers; for he recommends urine that has a white ſediment, which is light and uniform, as a very good ſign, denoting that the matter of the diſeaſe is attenuated, and evacuated from the body. But he calls this change in the urine a corruption, where he ſays, [a] *But the putrid*

ſtate

[a] Putredo autem humorum, quæ fit in vaſis, ſimilis eſt illi quæ fit in inflammationibus et abſceſſibus et aliis tuberculis, &c. *De Febribus, lib. i. cap. 7. Charter. Tom. VII. p. 115.*

ſtate, which the humours acquire in the veſſels, is like that which happens in inflammations, abſceſſes, and other tumours, etc. He likewiſe tells us there are two kinds of this corruption: *Namely, one which happens when nature overcomes the diſeaſe; and another, when the diſeaſe overcomes nature. When nature overcomes the diſeaſe, there is a formation of matter like that which is made in inflammations, and as happens in all tumours; but that which ſubſides in the urine reſembles matter when in the humours of the arteries and veins. But this kind of corruption is not ſimply a putrefaction, but a kind of concoction or digeſtion; for while the digeſtive or attenuating power of the veſſels remains, the corrupting humour is reduced to the ſtate abovementioned* [b]. From hence it evidently appears, that the formation of matter is very different from a ſpontaneous putrefaction of the humours.

But the change of an inflammation to ſuppuration, when it is not reſolvable, ſeems to be performed in the following manner. The humours urge upon the back of the obſtructions, and enter the obſtructed veſſels at every contraction of the heart, with a velocity increaſed by the attending fever; from hence the ſides of the obſtructed veſſels will be gradually diſtended, and ſeparated from their cohefion with the extreme parts which remain obſtructed: but while this is performing, the humours are extravaſated from their ruptured veſſels; and, being attenuated by the warmth of the parts, they enter into an incipient putrefaction, and diſſolve the impervious fluids which heſitated in the extremities of the ſeparated veſſels, together with the tender ſolid parts which before contained the obſtructing matter; all which being worked up together, attenuated, and intimately mixed with the extravaſated juices, they receive ſuch a change by warmth and ſtagnation, that the whole forms a ſimilar or uniform fluid, called *pus* or *matter*. It may perhaps ſeem ſurpriſing, that

[b] Alterum nempe fieri, vincente natura; alterum vero, devicta. Vincente quidem natura, uti in inflammationibus et tuberculoſis omnibus tumoribus pus fit; in humoribus autem arteriarum et venarum illud, quod ſubſidet in urina, puri analogum. Hæc autem putredo non ſimpliciter putredo eſt, ſed aliquid coctionis habet. Manente enim concoquendi facultate vaſorum, putreſcens tunc humor ad talem alterationem reducitur. *Ibid. cap.* 8. *p.* 116.

that the ſolid membranes of the veſſels ſhould be thus diſſolved, and mixed with the juices, in ſuch a manner as to form a fluid which is uniform in appearance; but the difficulty will be removed, if we conſider the incredible tenuity of theſe ſmall veſſels. For it appears from the eſtimates made from the obſervations of Leeuwenhoeck and other learned men, that almoſt fifty millions of red-blood globules, do but equal the weight of a ſingle grain [c]. But the ſmalleſt ſanguiferous arteries tranſmit only one ſuch globule at a time; from whence it is evident how ſmall and tender theſe vaſcules muſt be: and yet theſe ſmalleſt ſanguiferous arteries are ſtill the largeſt among the ſmaller or decreaſing ſeries of thoſe veſſels. But we proved before, that a true ſanguine inflammation might be alſo ſeated in the ſerous and in the lymphatic arteries: Will it therefore any longer ſeem ſurpriſing that the ſolid ſtamina or threads of thoſe ſmall veſſels ſhould be thus diſſolved and mixed with the fluids ſo as to diſappear? We ſometimes obſerve in conſumptive people, that the whole ſubſtance of the lungs has been ſpit up in the form of matter; inſomuch that, upon opening the body after death, the phyſicians have with good reaſon wondered how life could be continued ſo long with ſo ſmall a part of this important viſcus remaining.

That fluid which is formed of the extravaſated humours and tender ſolids combined together, and mixed by attrition, is called *pus* or *matter*; which when laudable, or formed by a perfect maturation, after an irreſolvable inflammation, has the following conditions, *viz.* it appears white, and almoſt of the thickneſs of cream, unctuous to the touch, and uniform in every particle, without any manner of foreign ſubſtance. But when matter has not theſe conditions, it is ſaid to be bad. All this has been remarked by Hippocrates, in his Prognoſtics, where he ſays, *But the beſt matter is white, uniform, ſmooth, and the leaſt fetid; but matter which is the moſt contrary to this, is of the worſt kind* [d].

And

[c] Medical Eſſays, Vol. II. p. 113.

[d] Pus autem optimum eſt album, et æquale, et læve, et minime fœtidum: quod autem maxime huic contrarium eſt, peſſimum eſt. *Sentent. 42. Charter. Tom. VIII.* p. 617.

And thus Celſus, in treating of what is diſcharged from he wounds and ulcers, namely, concerning blood, oul matter, and ichor, &c. ſays, *Among theſe, pus or matter is the beſt. But of this the worſt kind is that which s very thin and dilute; eſpecially if it was ſo from the eginning: and it is alſo bad, when the colour of it is ike ſerum, pale, livid, or feculent: to which add, an ill mell, except it be derived from the part. The matter is the etter, as it is leſs in quantity, thicker, and whiter; appearing alſo ſmooth and uniform, without any ſmell* [e]. A ittle afterwards he well obſerves, that the matter beng formed, terminates the inflammation: for he ſays, *That the matter ought alſo to be agreeable to the magnitude and the age of the wound; for more matter is naturally diſcharged from a larger wound, and more before he inflammation is gone off* [f]. Now when the inflammatory matter is too ſtubborn or compact to be digeſted into pus, or when the concocting powers are weaker than is neceſſary for that purpoſe, or when both of theſe concur; then there is not a matter formed as above conditioned, but the fluid produced leviates more or leſs from thoſe conditions, as Galen well obſerves in his explanation of the text of Hippocrates laſt cited. For after having ſaid, that the blood s, in a phlegmon, transfuſed into the void ſpaces near he veſſels (that is, into the cellular membrane,) he ays it cannot then return to its former ſtate, but will hange and putrefy in the ſame manner as all other uices do which are violently heated in ſome foreign part; and he then adds, *So that if the innate heat is too ow, or deviates much from its proper temperature, the lood then putrefies as in a dead body. But if it as yet retains ſome force, the blood then undergoes a kind of nixed alteration, partly from the deficiency of nature, and partly*

[e] Pus inter hæc optimum eſt. Sed id quoque pejus eſt, multum, tenue, dilutum; magiſque, ſi ab initio tale eſt: itemque ſi colore ſero ſimile, pallidum, ſi lividum, ſi fœculentum: præter hæc, ſi male olet; ſi tamen locus hunc odorem excitat. Melius eſt, quo minus eſt, quo raſſius, quo albidius: itemque ſi læve eſt, ſi nihil olet, ſi æquale eſt. *Lib.* v. *cap.* 26. nº 20. *p.* 289.

[f] Modo tamen convenire et magnitudini vulneris et tempori debat. Nam plus ex majore, plus nondum ſolutis inflammationibus naturaliter ertur.

partly from that power which ſhe yet retains; and therefore there follows a putrefaction of that which is preternatural, and a concoction of that which is agreeable to nature. But which of theſe conditions prevails moſt, may be known from the neceſſary conſequences or ſigns which immediately appear both in the warmth, in the ſmell, and in the conſiſtence of the matter [g].

The formation of matter therefore depends on, or reſults from, the remaining health; whence it is juſtly reckoned by Hippocrates among the worſt ſigns of diſeaſes, for an ulcer, whether bred before or in the diſeaſe, to become dry and diſcharge no more matter; for he pronounces that ſuch a patient cannot long ſurvive.

But that the inflamed part tends to ſuppuration, is known from the following circumſtances.

If the circulating humour is mild.] For if there is any conſiderable acrimony in the humours, it will be ſtill much more increaſed by the ſtagnation and greater heat of the inflamed part; from whence would follow an eroſion and deſtruction of the veſſels, inſtead of that mild ſuppuration of their obſtructed ends only which happens in a ſuppuration.

Its motion ſwift.] In the reſolution of an inflammation, a ſedate motion of the humours is equally neceſſary with their mildneſs; but when a ſuppuration follows, there is always a greater velocity of the circulation: Whence a ſuppuration ſeems to be a ſort of medium betwixt a reſolution and a gangrene. In a reſolution, the concreted or ſtagnating humours are removed and reduced to their former ſtate of fluidity; without offering any further injury to the veſſels, or making any evacuation of the impervious juices: but in a gangrene, there is a true death of the inflamed part, which muſt therefore be ſeparated afterwards from the adjacent living veſſels. Now, in a ſuppuration, the

[g] Itaque ſi innatus calor a propria temperie plurimum receſſerit, ſanguis, ut in cadavere, putreſcit. Si autem ille adhuc aliquam vim retinet, mixta quædam ſanguinis mutatio fit; partim quidem ab ea quæ præter naturam, partim vero ab illa quæ ſecundum naturam cauſa eſt; quarum ut illa, quæ præter naturam eſt, putrefacit; ſic illa, quæ ſecundum naturam eſt, cauſa concoquit. Earum vero utravis prævaluerit, protinus indicia, tum in colore, tum in odore, tum in conſiſtentia, neceſſaria conſequuntur. *Comment.* i. *in Prognoſt. Hipp. Charter. Tom. VIII. p.* 618.

the ends only of the obſtructed veſſels are ſeparated or thruſt off, and, mixing with the extravaſated humours, are formed into matter, under which appearance they are to be diſcharged; and in this a ſuppuration differs from a reſolution: but from a gangrene it differs, in as much as a ſuppuration does not deſtroy all the parts affected. Hence, therefore, the particular velocity of the humours through the part, as well as that of the whole maſs in general, which accompanies an inflammation, ought to be very ſedate, to afford any hopes of obtaining a reſolution: on the contrary, it is evident, that if a violent fever attends, a gangrene muſt ſoon follow: but if the motion is not ſo ſedate as in a reſolution, nor yet ſo ſwift as is uſual in a gangrene, the inflammation muſt then terminate in an abſceſs or ſuppuration. Hence, when there are no hopes of obtaining a reſolution, it may be as pernicious to leſſen the fever too much, as imprudently to render it more violent; as will appear more evidently hereafter, in the commentary on §. 403, n° 3.

The obſtruction large, *&c.*] In what reſpect an obſtruction is to be termed large or ſmall, as alſo what ſigns there are denoting its reſolution, has been already declared under the preceding aphoriſm. But an inflammation is principally known to tend to a ſuppuration by the increaſing of the tumour, heat, pain, redneſs, and other ſymptoms enumerated in the aphoriſms here cited: But theſe ought not to increaſe very ſuddenly, for then they rather threaten a gangrene; but they ſhould rather make a conſtant and gradual increaſe. It would perhaps be a difficult matter to know exactly the bounds, where the poſſibility of a reſolution terminates, and where an incipient ſuppuration begins; but this is certain, that the pain, pulſation, fever, heat, *&c.* do manifeſtly increaſe at the time when the inflamed part ſuppurates. But when the ſuppuration is finiſhed, all thoſe ſymptoms are again diminiſhed; as Hippocrates very well obſerves, where he ſays, That the pain and fever are more intenſe about the time of the formation of matter, that when the matter is quite formed[h]. Nor is

[h] Aphor. 47. ſect. 2. Charter. Tom. IX. p. 85.

is this at all ſurpriſing, ſince the diſtended veſſels muſt excite the moſt acute pain at the time when they are neareſt to a rupture; but when they are once broken, the pain thence ariſing immediately ceaſes. See §. 221.

§. 388. IF the humour is acrimonious, violently moved, the obſtruction large, and the veſſels rigid, then all the ſymptoms (382, 386, 387) are violent; and the ſmall veſſels ſuddenly burſting open, their juices become putrefied: hence an ichor is extravaſated, and collected, like the waſhings of fleſh, in bliſters under the cuticle; or elſe there appears a yellow, pale, aſh-coloured, brown, or black-coloured foul matter: in the mean time, the redneſs, pain, heat, pulſation, and tumour, leave the affected parts, and invade thoſe which are adjacent; whereupon follows a death of the part affected, which is termed a *gangrene;* being the third manner in which an inflammation ſometimes terminates.

We come now to the third manner in which an inflammation terminates, which is called a *gangrene.* When the vital circulation of the humours through the arteries and veins is from any cauſe deſtroyed in ſome ſoft part of the body, it occaſions a death of that part; which, while beginning and performing, is termed a *gangrene.* Therefore this manner of terminating an inflammation differs from a ſuppuration, in as much as all the motion of the humours is entirely deſtroyed in the affected part by a ſudden rupture of its ſmall veſſels; whereas, in a ſuppuration, only the extremities of thoſe veſſels are gradually ſeparated, by the motion of the vital humours urging behind. But an inflammation more eſpecially tends to a gangrene, when attended with the following circumſtances.

If the humour is acrimonious.] Any very ſharp ſubſtance or liquor applied externally to the body, cauſes a gangrene, whether it be acid, alcaline, or of any other

other ſpecies of acrimony. For thus true gangrenous eſchars are formed, by touching the ſkin either with oil of vitriol, the potential cautery of the ſurgeons (formed of a ſharp alcaline ſalt, boiled up with quick-lime), the acrid empyreumatic oils of hartſhorn or lignum guaiacum, the volatile alcaline ſalts, *&c.*; and the ſame thing alſo happens when the maſs of blood itſelf is infected with acrimonious particles. It is indeed true, that theſe acrimonious particles cannot eaſily enter into the blood; and yet we obſerve in diſeaſes, that the humours frequently degenerate ſurpriſingly into an acrid ſtate, by which the ſoft parts are often ſuddenly corroded and deſtroyed. In the worſt ſpecies of the ſcurvy, the gums are often deſtroyed by a true gangrene or putrefaction, with an intolerable ſmell; and the moſt malignant ulcers, ſuddenly tending to a gangrene, ariſe in various parts of the body, and eſpecially in the legs. The like diſaſters are alſo obſerved to follow from a turgeſcence of the veſſels with atra-bilis joined with a violent motion, as we ſhall explain more at large in §. 1104. From whence it is evident, that if a conſiderable acrimony of the blood is alſo accompanied with an inflammatory ſpiſſitude or tenacity, then the veſſels muſt be ſuddenly deſtroyed, and a gangrene produced.

Violently moved.] We have already ſeen, that a ſedate motion of the humours favours the *reſolution* of an inflammation, and that a motion more ſtrong or ſwift promotes a *ſuppuration*; but a motion ſtill more violent will act ſo forcible upon the obſtructed ends of the ſmall arteries, as to break them all open ſuddenly, and not produce a gradual ſeparation of them as is done in a ſuppuration. But a ſwift motion of the circulating humours throughout the whole body, is known by the quickneſs of the pulſe, and frequency of the reſpiration; while the moſt intenſe pain and heat alſo denote the ſame thing in the inflamed part. If then an acrimony of the humours be added to their increaſed motion, it is evident that theſe very fine veſſels muſt be ſpeedily deſtroyed; ſince the humours are in this caſe applied not only with an acrid or diſſolving

power, but alſo with a greater impetus, and oftener in a given time. It was alſo demonſtrated in the commentary on §. 100, that a bare increaſe of the circulation renders the ſalts and oils of the blood more acrimonious; and from hence again will ariſe a new ſtimulus, increaſing the velocity of the circulation, ſo as to be ſtill more productive of itſelf. From all which it is ſufficiently apparent, what danger an inflamed part is in when a violent fever attends.

The veſſels rigid.] It was demonſtrated in the commentaries on §. 52, that an increaſed rigidity or too great a ſtrength of the veſſels rendered the blood very thick or compact, and diſſipated its more fluid parts, by which means it became more inclined to concretion. And we obſerved in §. 386, that a mobility of the flexible veſſels, and a diluting vehicle, are two of the chief means from whence we are to expect an inflammation to be reſolved: and therefore if the contrary of theſe take place, they will be always followed with more fatal conſequences. As in this caſe the humours move through the veſſels with a great velocity, their whole impetus will act upon the ends of the obſtructed veſſels, a great part of which impetus would have been otherwiſe ſpent in dilating the ſides of the flexible veſſels: and from hence the ends of the veſſels will be ſuddenly forced or broken off by this greater impulſe or more ſudden action of the humours upon the obſtructed matter; whence will be occaſioned all the conſequences hereafter enumerated. And from hence alſo the reaſon is evident, why inflammatory diſeaſes are generally ſo fatal in people who have been addicted to hard labour.

Then all the ſymptoms are violent.] If the tumour of the inflamed part ſuddenly increaſes, and the redneſs becomes intenſe or inclines to a purple, the heat burning, and the pain ſevere or continually increaſing, accompanied with a quick pulſe and a difficult reſpiration, *&c.* a gangrene will then follow in a little time.

The veſſels are ſuddenly broken, *&c.*] If now we conſider that an acrid humour is here violently impelled againſt the ends of the veſſels, ſo obſtructed with imper-

impervious matter that they are quite incapable of transmitting any part; it will readily appear, that we ought to expect a ſudden rupture or diſſolution of thoſe veſſels, and this eſpecially if the too great rigidity of the veſſels renders them leſs apt to be diſtended without breaking. The veſſels once broken, they extravaſate their juices: theſe ſpontaneouſly corrupt, and that in a little time; ſince the intenſe heat, which always accompanies a violent inflammation, very much promotes putrefaction, as was ſaid before at §. 84, nº 5. But while all this is performing in the inflamed part, there are certain ſenſible alterations to be obſerved, which teach us, that a gangrene is already preſent, or will very ſuddenly follow. Theſe appearances are perfectly like thoſe which ariſe from the application of fire to any part of the body, as we obſerved in the commentary on §. 370. For then the cuticle begins to ſeparate from the ſubjacent ſkin, and becomes elevated into bliſters by the extravaſated humours; which bliſters are generally filled with a reddiſh-coloured ichor, or in a worſe ſtage of the diſorder with a thin yellow matter: the ſhining redneſs of the part then changes into an aſh, pale, brown, or even at length into a black colour; and the diſorder is known to have made a greater or leſs progreſs, in proportion as the colour inclines from that of a pale aſh to blackneſs. Hereupon all the ſymptoms of inflammation diminiſh, and ſometimes they ſeem entirely to diſappear; nor need we wonder at this, ſince the inflammation ariſes from an increaſed velocity of the humours from the vis vitæ which remains. Hence the redneſs diſappears, and the blood is no longer impelled through the veſſels of the part affected; and ſince for the ſame reaſon the nervous fibres of the veſſels are no longer diſtended, the pain alſo ceaſes. Since the heat and pulſation ſuppoſes a violent attrition betwixt the impelled fluid and the ſides of the veſſels, therefore they alſo diſappear when a gangrene follows upon an inflammation; and hence a ſudden ceſſation or remiſſion of the pain and other ſymptoms in acute inflammatory diſeaſes is juſtly eſteemed fatal, if the proper ſigns have not firſt preceded. For when

a gangrene arifes after a violent inflammation in fome *external* part of the body, it is eafily apparent from the forementioned figns, whether the diforder is prefent; but when the *internal* parts of the body fuffer the like diforder, a fudden ceffation of the pain affords the principal fign of the gangrene. Thus, in the moft violent pleurify, and moft painful inflammation of the inteftines, the acute pain often fuddenly goes off, and the patient perifhes foon after he imagined the diforder to be overcome. Thefe are the fallacious changes in the worft difeafes, which often prove prejudicial to the character of a phyfician; for being thus deceived, he imprudently prefages a happy event of the difeafe, which yet proves fatal in a little time.

The veffels being therefore deftroyed, all the vital influx and efflux of the humours into the affected part will be abolifhed; that is, a death of the part follows; and then all the confequences of a fpontaneous corruption of the mortified part are at hand. If we look into thofe changes which are made in the flefh of animals lately killed, and expofed to a warm air, they will appear to be almoft the fame with what we obferve in gangrenous parts. For the lively red colour of the flefh begins firft to difappear; a pale afh colour, gradually inclining to brown, fucceeds; at length it turns almoft black; and what but a little before was folid flefh, now melts down into a ftinking matter: but all thefe fymptoms happen fooner in the gangrenous part, as the warmth of the adjacent living parts increafes the putrefaction of thofe which are mortified.

But the adjacent parts which are not dead having their humours as yet pervious, thofe humours will be obftructed in the borders of thofe parts which interpofe between the dead and the living, being incapable to pafs through the part which is already dead: and from hence a new inflammation arifes as it were round the gangrene; after which, a fuppuration following, the dead or gangrenous parts are feparated from the living, or elfe the gangrene fpreads into the contiguous parts by the deftruction of the vital motion of their humours. But what has deceived fome unwary phyficians,

ans, is their believing the part to be not yet gangrenous, becauſe there is a pain ſtill perceived in it; tho', properly ſpeaking, there is not any ſenſation in the gangrenous part, but a pain ariſes only in thoſe ſubjacent or ambient parts which are yet living and inflamed. But it is always eſteemed a good ſign if the whole compaſs of the gangrenous part appears red, painful, hot, tenſe, *&c.* (provided the ſymptoms are not ſo violent as to turn the inflammation into a gangrene): for we then know, that the life remaining in the reſt of the body, endeavours to ſeparate the gangrenous or corrupted from the adjacent living parts.

§. 389. WHEN a part thus affected (388) is compreſſed externally, or the intenſe heat diſſipates much of the moiſture, then the dead part is indurated and dried up like leather; and the ſubjacent parts, having their circulation thereby choked, corrupt.

Now in the part where the gangrene is ſeated, there is no motion of the humours through the veſſels, but a mere reſt or ſtagnation of them; from whence the ſame changes follow there, as happen from the ſame cauſes in a dead body. The heat of the living ſubjacent parts, if alſo accompanied with a moiſture, converts all that is mortified into a putrid matter; but if their moiſture is exhaled either by intenſe heat or external compreſſion, then the part mortified is dried up and hardened like a black and dry ſkin or leather, being frequently ſo rough as to be ſcarcely diviſible by a razor. But this is chiefly obſerved in the external parts which are covered with the ſkin; for in other parts the gangrene rather diſſolves them into a putrid matter. Thus in a man who died of an incarcerated rupture, I ſaw the inteſtines were converted into a putrid matter, tho' he was before in health, and the diſeaſe was but of two days continuance. But when a gangrene ariſes, in acute diſeaſes, about the os ſacrum and coccyx, from the patient's lying too long on his back, there appears then very black and dry ſpots in the affected ſkin. But how

ſuddenly a gangrene may ariſe, and the ſkin grow black and hard like leather, even in an healthy perſon, barely by an external compreſſion, may be learnt from the following accident. While two carpenters were preparing the vaſt body of a tree, in order to make it into the axis of a mill; in turning it round, it unfortunately happened to give way while it was elevated by the handſpikes, and by its weight threw both the men into the adjacent pit, where one of them was inſtantly preſſed to death by the weight of it, and the other was obliged to ſuſtain the weight of it for above half an hour lying upon the ſpine of the tibia of his left leg. Luckily the bottom of the pit was covered with a good deal of ſoft mud, which prevented the preſſure from doing ſo much injury as it otherwiſe might; ſo that the man returned home joyfully without being much hurt, being able to ſtand and walk upon his legs for above a quarter of an hour without detriment: but I being called on the next day, found many large and ſmall black ſpots in the anterior part of the leg where the os tibiæ has its ſurface covered almoſt with nothing but the integuments, and theſe ſpots reſembled a withering or deadneſs ariſing from contuſion; but, after a more ſtrict examination, the ſkin of thoſe parts appeared very black and hard like leather. For the rough ſurface of the beam had ſo compreſſed the ſkin by its weight againſt the ſubjacent bone, that it became quite deſtitute of all the vital influx and efflux of its humours; and afterwards all thoſe dead parts were ſeparated by a ſuppuration formed all round their margins. Here I had a fair opportunity of ſeeing what a bare compreſſion was capable of effecting; and of perceiving the reaſon why thoſe parts of the ſkin, upon which almoſt the whole weight of the body is ſupported when a perſon lies long in bed, ſometimes ſo ſoon mortify in diſeaſes. But when this hard part of the ſkin like leather is preſſed againſt the ſubjacent living parts, they are inflamed, ſo much tumefied, and likewiſe compreſſed, (if the horny matter cannot be ſeparated from the living parts to which it adheres,) that the diſorder by that means ſpreads itſelf deeper.

§. 390.

§. 390. THIS change of an inflammation into a gangrene (388) is ſpeedly promoted by the uſe of every thing which is actually or potentially cold; by ſuch things as aſtringe, coagulate, or repel; by ſuch as are fat, acrimonious, emplaſtic, or narcotic; and by ſtrong ligatures, or an external compreſſion.

This aphoriſm enumerates thoſe things, which, being applied to the inflamed parts, are found to cauſe a ſudden change of an inflammation into a gangrene.

Things actually or potentially cold.] Among thoſe cauſes which diſpoſed an inflammation to turn to a gangrene, we enumerated, A large obſtruction, and a rigidity of the veſſels; ſee §. 388. But the effects of cold are, A greater contraction and ſtrength of the ſolids, and a tendency to increaſe the impervioufneſs of the fluids. The moſt intenſe cold will therefore quite intercept the circulation of the humours, by congealing them, and by contracting the veſſels; whence a ſudden mortification of a part often follows from a ſevere froſt: but when the vis vitæ is capable of removing the obſtructions in the frigid part, then an intenſe heat ariſes from an attrition of the more condenſed humours thro' their contracted veſſels; which laſt is a thing frequently experienced by thoſe who have been rubbing their hands with ſnow, when the uneaſy ſenſe of cold is ſoon followed with an intenſe heat. From hence it is evident, that the application of cold things to an inflamed part muſt be prejudicial, inaſmuch as they either totally intercept the circulation, or excite a more intenſe heat afterwards in the parts which are already too hot. But ſometimes the application of cold things may be ſerviceable, when the groſſer parts of the humours have entered the ſmaller veſſels by an error of place; as the veſſels, being contracted by the cold, may repel the matter back into the larger branches: and this more eſpecially when the diſorder is ſeated in the thinner humours; ſince the red part of the blood immediately congeals in cold water, but the ſerum and thinner lymph does

does not. But it is apparent, that no good can be expected from the application of cold things, unleſs the diſorder is recent, and at the ſame time mild; for if the obſtructing matter of the inflammation is ſo impacted in the ſmalleſt extremities of the veſſels as to be quite ſtagnant, the diſorder will be then rather increaſed. Now all this is exactly agreeable to the doctrine of the ancients. Thus Hippocrates [a], after having in two places obſerved, that cold, among other evils, produces gangrenes or blackneſſes, (μελασμους), ſoon afterwards adds, that it may be ſometimes ſerviceable; and enumerates the uſes of cold things. Thus they may be ſerviceable (ſays he) when inflammations and heats incline to a red or blood colour, from recent blood; but, in inveterate inflammations, cold turns them to a gangrene or blackneſs. It is alſo ſerviceable in an eryſipelas which is not ulcerated; but is prejudicial in one which is ulcerated [b]. And though Galen recommends the uſe of coolers in a phlegmon, he yet adds ſome good cautions, when he ſays, *And in truth coolers and aſtringents, rather than diſcutients, are to be uſed to incipient phlegmons: and this more eſpecially when the obſtructed matter is not groſs or thick; for when the obſtructing matter is wedged into the veſſels of a part violently inflamed, there is no more opportunity to uſe repellents, but then it is time to procure a diſcuſſion* [c]. He certainly could not have ſaid better if he had underſtood the nature of an inflammation from the preſent known laws of the circulation. And in another place, in treating on the cure of an eryſipelas, he obſerves, that this diſorder requires more cooling than a phlegmon; and then he adds, *But let the uſe of coolers be determined by the change of colour in the part; for by this means a true eryſipelas ſoon goes off: but it is not ſo if you cool even a little*

[a] Aphor. 17. & 20. ſect. 5. Charter. Tom. IX. p. 204, 205.

[b] Ibid. Aphor. 23. p. 208.

[c] Magiſque profecto ad incipientes phlegmonas frigidis et adſtringentibus, quam diſcutientibus, eſt utendum: atque etiam magis, ubi craſſum non eſt, quod confluit. Vehementi enim in parte inflammata incuneatione (σφηνωσεως) facta, non eſt amplius repercutientibus utendum, ſed tunc tempeſtivum eſt diſcutere. *Meth. Med. lib.* xiii. *cap.* 6. *Charter. Tom. X. p.* 301.

little too much, ſo as to make the ſkin livid in an eryſipe-las which is not a true one, but in ſome meaſure phlegmo-node. If a perſon does not deſiſt according to the above rule, the part turns black, and this eſpecially in old people; inſomuch that the parts, which have been thus refrigera-ted, cannot be then perfectly cured, even by the uſe of diſ-cutient medicines, without leaving a kind of ſcirrhous tu-mour behind, [d] &c. From whence it is ſufficiently e-vident how precarious and uncertain it is to uſe coolers for the cure of inflammations, ſince they are by that means ſo eaſily converted into worſe diſeaſes, if they are not uſed in the very beginning of the diſeaſe, or in thoſe caſes where the inflammation ariſes from an er-ror of place, not of the red blood, but of the thinner humours; as for inſtance in the eryſipelas, the oedema validum, and the like.

Things called *potentially cold* are thoſe which remove or diminiſh the heat of an healthy body to which they are applied, even though the things themſelves were actually warm, or at leaſt not much colder than the part itſelf of the body to which they are applied. They are therefore ſuch things as either diminiſh, or totally remove, the cauſes of heat in the part. But heat a-riſes from the motion of the fluids through the veſſels; which motion being diminiſhed, the heat decreaſes; and the reverſe: whence it is evident, that thoſe things are ſaid to be potentially cold, which either remove or diminiſh the ſtrength and velocity of the circulation. Thus warm water applied to an inflamed part may re-move or diminiſh the too intenſe heat, by relaxing the veſſels, and diluting the obſtructing particles: from whence it may be ſaid to be potentially cooling, not-withſtanding it is actually warm. Now it is very evi-dent, that theſe and the like potentially cooling reme-dies are ſeldom prejudicial to inflammations, as will ſtill

d Eſto autem refrigerationis terminus coloris mutatio. Etenim exqui-ſitum eryſipelas ſtatim cum hac quieſcit: non exquiſitum vero, ſed quo-ammodo phlegmonodes, ſi pluſculum refrigeris, lividam cutim facit. Si ne ſic quidem quis deſiſtat, nigreſcit, et potiſſimum in ſenilibus corpo-ribus: ſic ut quædam ita refrigeratorum ne quidem diſcutientibus medi-camentis perfecte ſanentur, ſed relinquant ſcirrhoſum quemdam tumo-rem in parte, &c. *Ibid. lib.* xiv. *cap.* 3. *p.* 320.

ſtill more plainly appear when we come to the cure o an inflammation; for theſe laſt do not deſtroy the mo tion of the humours through the veſſels, but they re ſtore the equality of the circulation by removing th obſtructions: But thoſe which cool by intercepting th vital circulation, are highly pernicious; which we ar told is the conſequence of ſome poiſons. Thus whe Socrates had drank the juice of the cicuta, he felt hi legs grow cold; and that coldneſs aſcending above th pubes, he preſently expired.

Which aſtringe or coagulate.] For by theſe the ca pacity of the veſſels is diminiſhed, and their humour are rendered impervious: both which conſequence tend to increaſe the cauſes of the obſtruction; an hence deſtroy the free motion of the fluids thro' thei veſſels, which, when totally aboliſhed, forms a preſen gangrene in the part.

Repel.] The inflamed part tumefies, and that ofte to a great degree, for the reaſons before mentioned, a §. 382, nº 1, 2.; from whence the ancient phyſician concluded, that a matter was here accumulated, whic was not there before, and which muſt therefore hav been derived from other parts. Now as they obſerve that this accumulation was often made very ſuddenly they judged it aroſe from an afflux of humours; an therefore placed the cure of the diſorder in repellin them, eſpecially towards the beginning of the diſeaſe as was a little before proved under the ſame aphoriſm in the paſſage quoted from Galen. That ſuch a repul ſion of the blood from the ends of the arteries toward their baſes is practicable, is evident from the moſt cer tain obſervations. The moſt healthy perſon, who i ſuddenly ſtruck with fear, has inſtantly a paleneſs o his face and lips, which denotes that the red blood i repelled towards the heart and larger veſſels; an therefore a palpitation of the heart, with anxiety, ſoo follow this paleneſs. The ſame alſo manifeſtly hap pens when a perſon faints away. Now the particle of the blood, which are repelled in theſe caſes, ma be alſo repelled from the ſmaller into the larger veſſel by the ſame action when they have miſtaken thei

courſe

ourſe; and thus may the obſtruction be reſolved. And how far this may be ſerviceable, was declared a ittle before, when we treated of the application of oolers to inflamed parts. But ſince all thoſe things, which are externally applied to cauſe this repulſion, ct by contracting the veſſels, it is very evident that heir uſe muſt be dangerous, except in the beginning of an inflammation ariſing from an error of place; nd that therefore, if they do not immediately prove erviceable, the diſorder will by that means be increaſed.

Such as are fat, acrimonious, or emplaſtic.] Concerning theſe, ſee what has been ſaid in the commentaries on §. 376. For ſince theſe are of themſelves ufficient to produce an inflammation, they will doubtleſs increaſe an inflammation ariſing from other cauſes; eſpecially if they adhere to the affected part by an emplaſtic tenacity; for then they render the part affected eſs perſpirable, and the mixed acrimony will remain long time fixed to the part.

Narcotic.] Theſe perhaps are in their own nature not ſo much to be condemned, eſpecially if they are rudently applied. But as all theſe only obtund the enſe of pain, leaving its cauſe remaining; therefore he inflammation often increaſes every minute, and a angrene follows by a deſtruction of the veſſels, without giving us any intelligence by the ſenſe of pain. But an acute pain, heat, pulſation, and the other ſymptoms, ſufficiently advertiſe both the patient and the hyſician of the ill conſequences which are to be feared or expected, unleſs they are deceived by removing the enſe of pain by the uſe of narcotics; whence in ſuch a caſe the moſt efficacious remedies, which might have prevented this termination of the inflammation in a angrene, are neglected.

Strong ligatures.] In what manner a gangrene may ariſe from hence, has been declared in the commentaries on §. 355. But it is very evident, that if a part already inflamed is compreſſed by a ſtrong ligature, the ſame diſaſter is to be expected much ſooner.

An external compreſſure.] Of this we treated under the preceding aphoriſm.

§. 391.

§. 391. AND all theſe cauſes likewiſe haſten a gangrene into a ſphacelus.

It was demonſtrated in the commentaries on §. 374 that a true phlegmon is moſt frequently ſeated in the cellular membrane, which it ſometimes diſtends to an immenſe bulk; inſomuch that the thin cellular membrane upon the back of the hand is ſometimes ſwelled to the thickneſs of two or three inches above the reſt of the ſkin. When therefore a gangrene follows an inflammation ſeated in this part, the whole corrupted maſs muſt be afterwards ſeparated. And it is no uncommon thing for one to be able to enter the ſcalpel to a conſiderable depth without any ſenſe of it, which might occaſion one to believe that all the ſubjacent parts are dead. But it very frequently happens, that the ſubjacent tendons and muſcles are living nevertheleſs; and then the gangrene is not yet become a ſphacelus: for in this laſt diſorder all the incumbent parts are mortified even to the bone, as we ſhall declare hereafter in the commentary on §. 429. But when the panniculus adipoſus is ſo much diſtended, already invaded with a gangrene, and in the mean time confined by the tough ſkin, it will compreſs all the ſubjacent parts, and therefore the vital circulation may be hence intercepted even in theſe; and then the gangrene paſſes into a ſphacelus or perfect mortification of the part. Every thing therefore which has been enumerated in the preceding aphoriſm, as capable of turning an inflammation into a gangrene, may alſo increaſe a gangrene ſo as to become a ſphacelus.

§. 392. IF the inflamed part is glandular, the internal or external heat great, the obſtructing matter thick and inactive; by obſtructing the emunctories of the glands, and by diſtending their follicles or cells, and their ſides or membranes, it produces a hard indolent tumour of a gland, which is called a *ſcirrhus*, and is the fourth manner in which an inflammation terminates.

We

We come now to the laſt way of terminating an inflammation; namely, when an inflammation is not resolved, nor the obſtructed parts ſeparated from thoſe adjacent which are ſound: in which caſe therefore the morbid will remain united to the ſound parts in ſuch a manner, that no future endeavour of nature, nor any of the preſent known aſſiſtances of art, can diſſolve it; but it can be no otherwiſe removed, than by the knife or by fire. Now, in thoſe parts of the body in which the blood paſſes every moment with a rapid motion through the veſſels, it is evident that the obſtructed matter cannot long remain without ſome alteration: for by this continual ſtruggle betwixt the impulſe of the blood and the re-action of the veſſels, either the obſtructing matter will be removed, digeſted into laudable matter by ſuppuration, or corrupted in a little time ſo as to form a gangrene or a ſphacelus. But when ſuch is the ſtructure of the affected part, that the arterial blood paſſes through its veſſels with little or no force, then there is danger leſt the obſtructing matter, being gradually deprived of its more fluid parts, will remain there immoveable, and form a hard indolent tumour which we call a *ſcirrhus*. Hence this way of terminating an inflammation is moſt frequently obſerved in the glandular parts, whoſe emiſſaries or excretory ducts being obſtructed, none of the ſecerned juices ſeparated by the fabric of the gland can eſcape; and theſe therefore being accumulated and inſpiſſated, by ſtagnating in the cavities or in the vaſcular compages, will fill and diſtend them: and as the circulating humours cannot here exert their impulſe upon this impacted matter, it will there remain deprived of its more fluid parts, and form an induration or ſcirrhus; of which we have a notable inſtance in an inflammation of the breaſt. For the milk ſeparated from the blood brought by the mamillary arteries, and ſtagnating in the lacteous ducts, begins to coagulate; in the mean time the thin ſerum diſtils from the ducts of the nipple, and the reſiduum remains inſpiſſated, and in a manner out of the courſe of the circulation; whence, after the inflammation is gone off, ſuch a hard indolent tumour often

often remains during the reſt of the patient's life. From hence likewiſe a ſcirrhus of the teſticles often follows after an inflammation of them: for if we conſider that the very ſmall ſpermatic artery, which ariſes from the trunk of the aorta, ſends out ſmall branches, which communicate and tranſmit the red parts of their blood by real anaſtomoſes into ſimilar ſmall veins, and then ſpends itſelf in an infinite number of convoluted ſmall branches placed orderly, and compoſing the ſubſtance of the teſticle; it will evidently appear from thence that the impulſe of the arterial blood upon the obſtructed veſſels, is here little or nothing; whence the obſtructing matter, being once impacted or fixed in theſe glands proves very ſtubborn, and forms a tumour inflexible to all means whatever. But a ſcirrhus follows an inflammation in a glandular part more eſpecially when attended with the following circumſtances.

A great heat, whether external or internal.] Women in childbed often commit the cure of their inflamed breaſts to their nurſes, or to ſome doting old woman; and as they fear nothing more than a ſuppuration, and an opening of the ſuppurated part by the ſurgeon's lancet, they therefore uſe all their endeavours to prevent it. If indeed they endeavoured to diſperſe the inflammation in time by the application of emollient fomentations, they could not be much blamed: but, on the contrary, they, by a dangerous error, expoſe the inflamed breaſt to the heat of a burning coal, or elſe continually foment it with very dry and hot linen cloths; or elſe they apply ſpirit of wine almoſt ſcalding; by which means, inſtead of a ſuppuration following, the more fluid parts are exhaled, and the reſt of the matter inſpiſſated into an irreſolvable ſcirrhus; and then the unhappy woman, who was ſo much afraid of a ſlight puncture with a ſharp lancet, is frequently obliged afterwards to undergo the very ſevere and dangerous operation of amputating. The ſame diſorder alſo frequently follows from the ſame cauſes, when the inflammation of a glandular part is accompanied with a violent fever.

The obſtructing matter thick and inactive.] Since milk

milk contains so large a quantity of a thick cheese-like crassamentum, which easily separates by stagnation from the thinner serum by which it was diluted; therefore a scirrhus more frequently happens in the breast, than in any other part. When the feculent or grosser parts of the blood are deprived of their more fluid juices, constituting what the ancients called atra-bilis, which infects the mass of humours almost with the tenacity of pitch; in that case, the slightest obstructions in glandular parts degenerate into scirrhi, as we shall declare hereafter in the commentary on §. 485.

Obstructing the emunctories of the glands, *&c.*] All those juices which have been secerned by the fabric of the gland from the affluent blood, ought to be discharged through the excretory ducts of each gland for their determinate uses. If now the discharge of the secerned juice is by any cause obstructed, it will consequently be accumulated, and distend the follicle or cell in which it was contained; and the most fluid parts of that secerned humour being either dissipated or absorbed, the remainder will be inspissated and rendered impervious. Now the impetus of the circulating humours may very well act upon the vessels which compose the membranes of the distended follicle, but not at all upon the matter contained in its cavity; whence it is evident, that the matter will remain there, incapable frequently of being resolved by any means whatever. But the more fluid parts being dissipated, even the thinnest of our juices may by stagnation concrete in a surprising matter. Thus the bile, stagnating in its vesicle, does often concrete into stones whenever its excretory duct is obstructed. Even the urine, which is more limpid, gives rise to the stone by being too long retained: and it will be made to appear hereafter, in the history of calculi, that such stony concretions are also formed sometimes in the ventricles of the brain, in the cavity of the abdomen, *&c.*; which parts are nevertheless furnished only (in their natural state) with a very thin dew, exhaling from the smallest arteries. The internal surface of the nose in an healthy person, being well cleansed, discharges a very thin lymph; yet this humour, after

having ſtagnated for ſome time, and exhaled its more ſubtle parts, will acquire even the toughneſs of a ſkin. Many more inſtances of the ſame nature might be alleged; but theſe are ſufficient to prove, that very thin humours in the body may give riſe to the worſt concretions.

§. 393. THE prognoſis of an inflammation is deduced from conſidering its cauſe, part affected, magnitude, depth, violence, the habit of the patient, the ſeveral ſymptoms; and by comparing theſe with the demonſtrative ſigns and effects or conſequences of the inflammation.

Having now conſidered the various ſigns and events of a preſent inflammation, it remains for us in this place to inquire into its prognoſis, which determines the good or bad event which we may reaſonably expect. In order, therefore, to know whether an inflammation inclines to a ſalutary diſperſion, a mild ſuppuration, a gangrene, or a ſcirrhus, we ought to conſider the following particulars.

The cauſe.] Thus, for example, the contagion of the ſmall-pox ſo alters the habit of the moſt healthy perſon, that in three days time the whole ſurface of the external ſkin, and often that of the œſophagus, ſtomach, *&c.* is beſet with inflammatory puſtules: In this caſe a reſolution can never be expected, but a ſuppuration always; or, in the worſt ſpecies, a true gangrene follows. But from the contagion of the meaſles, the external ſkin is inflamed indeed, but a ſuppuration never follows, and the diſorder terminates in a ſcaling off of the cuticle. Again, all authors who have attended people in the plague, have obſerved that inflammations ariſe in different parts of the body; which are ſometimes ſo ſevere, that the inflamed part is in a few hours time burnt up to a cruſt, which is afterwards ſeparated or caſt off from the other ſound parts by a ſuppuration of matter formed round its circumference. It is therefore apparent, that a very different event of an inflammation

is

s to be expected, according to the variety of causes from whence it may arise.

Part affected.] Namely, as it is more or less necessary towards life and health. Thus, for instance, in the hand, an inflammatory tumour, though violent, may be easily supported; but if a slight inflammation and tumour should be seated in the membrane which invests the parts about the glottis or its rima, the patient will be suffocated in a little time. If a phlegmon turns to a gangrene either in the hand or foot, the mortified part may then be separated from that which is living; but if the like disorder is seated in the brain, it is evident there can be little or no hope. But there is not only a more or less danger according to the different nature of the affected part, but also the way of terminating an inflammation is very different on the same account. In a glandular part, there is danger of a scirrhus; but in those parts of the body where there is much fat, an inflammation frequently terminates in abscesses and fistulæ very difficult to cure; as, for instance, about the anus, *&c.*

Magnitude.] For the larger the space which the phlegmon occupies, the more numerous are the obstructed vessels, and the greater is the quantity of the impervious fluids in those vessels; and at the same time the velocity of the circulation through the other vessels which remain pervious, is proportionably more violent, as was observed in the commentary on §. 382, nº 8. But all these circumstances are repugnant to those conditions necessary for resolving an inflammation, (see §. 386.); and therefore a suppuration or a gangrene is to be always expected in such a case.

Depth.] It was demonstrated, in the commentary on §. 374, that almost all parts of the body are capable of inflammation; but that it is in no part more frequently and obstinately seated, than in the tunica adiposa. Therefore a deep inflammation must be either seated in this membrane, or in other parts. If it is seated in the fat, which insinuates itself very deeply betwixt the muscles, then the efficacy of external remedies can scarcely penetrate so far; and if a suppuration

or a gangrene follows from such an inflammation, it will be very difficult to deterge or cleanse the parts. But if the inflammation is seated in the tendons, muscles, vessels, membranes, periosteum, or in the bones themselves; it is then evident for the same reasons, that its cure must be difficult. But what bad consequences may follow from an inflammation of the viscera themselves, we shall hereafter declare, when we come to treat of acute or inflammatory diseases.

Velocity.] While the impervious humours stagnate in the obstructed vessels, the blood which is impelled into them by the remaining vis vitæ, produces certain effects, which are also at the same time the signs of inflammation, enumerated in §. 382. But if these increase suddenly; if the redness, tumour, heat, pain, *&c.* increase every moment; we may easily foresee that the tender vessels will be ruptured in a short time, and that we are by no means to expect a resolution, but a speedy gangrene, (see §. 386.): and therefore a sedate motion of the humours is reckoned among those conditions which are required to disperse an inflammation; and, on the contrary, a swift motion of them denotes a suppuration or a gangrene to be at hand.

Habit of the patient.] Every individual person has his particular healthy state: and although the disposition of the solids and fluids appear very different in two several people, yet we often see that both of them enjoy a perfect state of health; but in such a manner, that one of them is inclined to one sort of diseases, and the other is more inclined to another sort of diseases. The rustic, who has been inured to hard labour, can hardly escape from a pleurisy; because his blood is very compact or thick, and, his vessels being rigid, there is little or no hope of obtaining a mild resolution: whereas, in those who are of a lax and weak habit, such inflammatory diseases are much more easily cured. But the morbid as well as the natural habit of the patient makes an inflammation terminate variously. Thus the cold and phlegmatic are seldom troubled with inflammations; or, if they ever are, but in a slight degree: But if a putrid scurvy should have infected the humours,

humours, the leaſt inflammation, or the ſlighteſt wound, often degenerates into the moſt ſtubborn ulcer, or a gangrene.

Symptoms, *&c.*] Of theſe we treated at §. 382. *et ſeq.* From conſidering all which, one may foreſee what event is to be expected from the inflammation; and thus the prognoſis is completed.

§. 394. IT is alſo apparent that the curative indications will be different according to the different ſtate of the diſorder.

We come now to deduce the curative indications from all that has been ſaid before, in order to direct us to the means proper to remove the known diſorder. But nothing is of more pernicious conſequence in medicine, than to preſcribe a general method of cure to a diſeaſe, without having a regard to the particular ſtate and various circumſtances of it. Thus in fact we have different diſeaſes which come under the denomination of a Pleuriſy; and which, though they are alike in their beginning, do yet often differ widely as they increaſe, and require a very different method of cure. And again, the ſame pleuriſy requires to be treated in a different manner at its beginning from what it does when it has continued for ſome days and afforded manifeſt ſigns of an incipient ſuppuration. There is therefore no general method of cure to be preſcribed in an inflammation; but it requires a different treatment, according as it inclines to terminate in this or that manner. It is indeed true, that an inflammation ought always to be removed if poſſible by a reſolution, when that ſeems practicable; but if, for example, there are ſigns of a gangrene, the only method that remains is to ſeparate the dead from the living parts by procuring a ſuppuration, to which end all the curative intentions are to be entirely directed: whereas again, ſo long as there are any hopes of a reſolution, all the endeavours of art are to be uſed to prevent a ſuppuration, eſpecially when the inflammation is ſeated in ſome internal part of the body. It will therefore be proper to conſider

ſider theſe four methods of terminating an inflammation ſeparately, and to deſcribe the treatment proper to each. In the firſt place, therefore, we ſhall treat of the cure of an inflammation by a reſolution; that is, by reducing the concreted and ſtagnant matter of the inflammation to a ſtate of fluidity and motion.

§. 395. FOR if any of the cauſes (375 to 379) have produced an inflammation (371) in any part (372, 373, 374, 379), which is attended with the ſymptoms (383, 384) and primary conditions (386); then the following indications ariſe.

1. To prevent further injury from being offered to the veſſels.
2. To remove that injury which they have already ſuffered.
3. To render and preſerve the obſtructing matter fluid and mild:
4. Or, if that cannot be performed, to repel it back into the larger veſſels.

As this diſtinction will be ſo highly uſeful in the cure of a pleuriſy, peripneumony, quinſy, and the like diſeaſes, therefore each of theſe particulars are to be well conſidered.

The condition of the diſeaſe whoſe cure we are about to deſcribe, is very exactly determined in this text. For from whatever cauſe the inflammation ariſes, or whatever part of the body it occupies, whether external or internal, a reſolution of it may be always attempted, provided it is recent, and attended with thoſe circumſtances which are enumerated in §. 386. And the inflammation may be thus terminated when there is a poſſibility of performing what is mentioned in the four following numbers.

1. To reſolve an inflammation, it is required to reduce the concreted or obſtructing matter to a ſtate of fluidity, and reſtore the ſtagnating humours to their proper motion; as we obſerved before at §. 386. But if the continuity of the veſſels is not preſerved, the humours

humours extravaſated from the broken veſſels will neceſſarily ſtagnate and corrupt. Now, in every inflammation, there is a tumour from the diſtenſion of the veſſels, and a pain from the diſtraction of their fibres, approaching near to a rupture; both which denote, that if the ſame cauſes continue to act, the veſſels will then burſt; and when the continuity of the veſſels is diſſolved, a ſuppuration follows; or elſe a gangrene, if that ſolution of their continuity happens very ſuddenly. It is therefore evident, that in order to reſolve an inflammation, it is neceſſary to prevent any further injury of the veſſels.

2. So long as the inflamed veſſels remain entire, their injury conſiſts in too great a dilatation, and a diſtraction of their ſides, by the impulſe of the vital humours againſt the obſtructions: if therefore this too great diſtenſion of the veſſels is removed, this indication will then be ſatisfied.

The two preceding curative indications relate to the ſolids; thoſe which follow reſpect the fluids.

3. The concreted or impervious fluid ſtagnates in the obſtructed veſſels; and as an inflammation can take place only in the arteries, (ſee §. 371), the impulſe of the humours urged behind will always drive the obſtructing matter further into the narrow parts of the veſſels: It is therefore required ſo to attenuate this matter, as that it may be capable of paſſing thro' the ſmalleſt extremities of the obſtructed veſſels. Yet a bare attenuation of the concreted fluid will not ſuffice, unleſs the mild or unacrid ſtate of the humours is alſo preſerved; for concreted blood may indeed be reſolved by a putrefaction, but then it alſo acquires a great acrimony. Now an acrimony mixed with the blood, which is in this caſe rapidly moved through the tender veſſels, already weakened by too great a diſtenſion, would deſtroy them in a very little time; whence a gangrene would follow, inſtead of a mild reſolution: for it was demonſtrated, in the commentary on §. 388, that an acrimony of the humours cauſes an inflammation to tend ſpeedily to a gangrene. It is therefore hence apparent, that the mild ſtate of the humours

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muſt be preſerved, beſides reducing them to a ſtate of fluidity.

4. Sometimes the orifices of the veſſels are ſo dilated as to admit ſuch groſs particles, that we can ſcarce hope to attenuate them ſo far as to procure a free paſſage of them through the ſmalleſt extremities of the obſtructed veſſels. Thus, in the worſt ſpecies of an ophthalmia, the red blood enters the pellucid veſſels even of the cornea itſelf, which are much more minute than thoſe of the tunica adnata; but thoſe veſſels, in their natural ſtate, will exclude all ſuch parts of the blood as have any colour: So that, although the red impervious blood which ſtagnates in theſe veſſels, ſhould be reſolved into ſerum; and that ſerum again into lymph, which is a degree thinner; yet its particles would not be capable of pervading the ſmalleſt extremities of theſe very minute vaſcules. There is therefore but one means left in this caſe to reſolve the inflammation; namely, To repel the obſtructing particles, from the narrow ends of the veſſels into which they are impacted, towards their larger baſes, and from thence into the larger veſſels; ſo that, being returned into the circulation, the obſtructing matter may be reſolved by the motion and attrition of the veſſels, and of the other contiguous particles.

§. 396. ANY further damage to the veſſels is prevented,

1. By removing or correcting the known cauſes (375 to 380.)

All that art can do in the cure of diſeaſes, is to reſtore the parts to their healthy ſtate: but the cauſes, which are enumerated in the aphoriſms here cited, are ſuch as may produce an inflammation even in the moſt healthy perſon; and therefore all endeavours will prove fruitleſs, unleſs theſe cauſes can be removed: as for inſtance, when an inflammation ariſes about the os ſacrum and coccyx, from a perſon's lying too long on his back, it will not be poſſible to prevent that inflammation from turning to a gangrene, unleſs the preſ-

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ſure of the incumbent weight of the body can be taken off; and the ſame is alſo true with reſpect to the other cauſes of inflammation.

2. By diminiſhing the force of the arterial blood by bleeding and purging.

There are two things which concur in the definition of an inflammation, as explained at §. 371; namely, a ſtagnation of the arterial blood in the ſmalleſt veſſels, joined with a preſſure and attrition from the reſt of the blood, which is more ſtrongly urged into the obſtructed part by a fever. Now the impervious blood ſtagnating in thoſe veſſels indeed cauſes an obſtruction; but there is from thence no further injury offered to the obſtructed veſſels, if they are not urged or diſtended by the impetus of the blood acting behind. Therefore the chief thing required to prevent the inflamed veſſels from ſuffering any further injury, will be ſo to diminiſh this impetus, as that the veſſels can be neither ruptured, nor more diſtended by the arterial blood; the motion of which cannot be totally removed, and at the ſame time life continued in the part; but yet it may be rendered ſo gentle as to do no further damage. And this is obtained by

Bleeding.] It was ſaid at §. 381, that the remaining life produces certain effects in the obſtructed parts, which are at the ſame time the *ſigns* of an inflammation: but the *malignity* of an inflammation is to be meaſured by the number and magnitude of theſe effects, which alſo indicate in what manner the inflammation will terminate. When therefore the vis vitæ is diminiſhed or rendered leſs active by any cauſe, thoſe effects which reſult from the impulſe of the vital humours into the obſtructed veſſels will be diminiſhed. Now we are able to diminiſh the impetus of the blood to any degree we pleaſe, even until death or a perfect reſt, barely by bleeding; and therefore we may reſtrain the force of the circulation more or leſs, according to the degree of this evacuation. Helmont [a], and many others after him, interdicted this waſting of the blood, as

a In capit. *Pleura Furens*, p. 319. nº 13.

as uſeleſs and pernicious, in the cure of inflammatory diſeaſes. For they believed, for inſtance, that a pleuriſy aroſe from an hoſtile acid, fixing itſelf like thorns into the intercoſtal membrane sand veſſels: "And therefore (cried they) bleeding is to no purpoſe, but we muſt remove the pleuritic ſpiculæ;—the medicinal profeſſors have all become votaries of the bloody Moloch!—the diſeaſe is to be conquered by ſpecific remedies, and not by weakening the ſtrength with bleeding [b]," *&c.* But it is evident, from what has been ſaid before, that theſe pleuritic ſpiculæ are nothing more than the impervious blood heſitating in the ſmall arteries; and that the humours, urging on the back of theſe obſtructions, drive in their ſpiculæ, that is, produce a pain from the diſtraction of the fibres. It is indeed true, that a perfect cure might be obtained, if the impervious blood, which there heſitates, could be inſtantly diſſolved, and reduced to a ſtate of fluidity: but whether Helmont could effect this by his boaſted ſpecifics; ſuch as goat's blood dried and reduced to a powder, eſpecially that which was diſcharged from cutting off the teſticles; the ſtag's pizzle; wild poppy flowers, *&c.* will appear very doubtful to one who reads how little ſerviceable they proved to himſelf in the like diſeaſe, as he relates towards the end of the ſame chapter. As therefore there has not been any remedy as yet found, which deſerves to be truſted as a ſpecific for reſolving immediately the ſtagnant and impervious blood in this diſeaſe, whether externally or internally applied; nothing more uſeful can be done, than to prevent the further ingreſs or protruſion of the obſtructed matter into the more narrow parts of the converging veſſels, and at the ſame to prevent it from growing more compact and firm: But both theſe intentions may be obtained by diminiſhing the force of the arterial blood; which may be moſt commodiouſly and ſafely performed by phlebotomy, as alſo by

Purging.] For, next to bleeding, this evacuation moſt effectually diminiſhes the force of the blood. In the Materia Medica, correſponding to this aphoriſm, you have a liſt of thoſe purgatives which act without much

[b] Ibid. p. 322.

much increasing the motion of the blood, and which even attenuate or dissolve our humours at the same time. And this method is recommended by Sydenham, who diligently inculcates the same in his *Schedula Monitoria* concerning the coming in of a new fever at that time; which treatise he wrote towards the end of his life, after he had spent thirty years in the practice of physic, and in diligently observing the course of nature in diseases. He there treats of an inflammatory fever, with a sudden determination of the morbific matter towards the brain: and after premising phlebotomy, he prescribes a purging draught *ex tamarindis, rheo, senæ foliis, manna*, &c; and in the evening he gave a gentle paregoric, to quiet the disturbance from the purge, though but slight. He repeated such a purge every other day to the third time; and by that means happily cured the disease, which was of its own nature dangerous enough: but he observes, that these purgatives were prejudicial, unless phlebotomy had been premised.

But it is very evident, that all these assistances of art are not required in every inflammation; but only in those cases which, by reason of the continuity of the affected part being absolutely necessary to life and health, will not admit of any other way of terminating the inflammation; or when the inflammation is seated in such a part of the body as will not admit of discharging the matter after a suppuration is made, from whence the most fatal consequences might be expected.

. By diminishing the quantity of the humours by the same means.

It was said in the commentary on §. 378, that one the most frequent causes of inflammation was too great a dilatation of the lymphatic arteries, by which they admit grosser parts of the blood than are able to pass through their small extremities. Also in the commentaries on §. 106, nº 4. and §. 118. it was demonstrated, that a plethora is one of those causes by which the orifices of the vessels are dilated. Since, therefore, bleeding and purging diminish the quantity of the humours,

mours, they will ſerve to remove thoſe cauſes of inflammation. Beſides this, the quantity of fluids being diminiſhed, there will be a leſs compreſſure and coheſion of the particles of the blood to each other; from which compreſſure the inflammatory ſpiſſitude of the blood very frequently ariſes. For if the blood impelled from the heart was to run into the arteries in an empty ſtate, it would there meet with no reſiſtance and conſequently could ſuffer no compreſſure: but when the heart forces out its blood into full arteries thoſe arteries muſt either be dilated, or the blood contained in their cavities muſt be compreſſed; and ſince the arteries reſiſt dilatation the more as they are fuller therefore in that caſe the blood will be condenſed or thickened. For this reaſon an inflammation is juſtly reckoned among the effects of a plethora, §. 106, n° 4. And therefore, by diminiſhing the quantity of the fluids moving in the veſſels, the body is rendered very much averſe to inflammation; and it rather inclines to an oppoſite diſorder, namely a dropſy, which uſually follows profuſe evacuations.

4. By making a revulſion of the blood's force into other parts by ſuction, friction, ſynapiſms, bliſters, fomentations, warm bathing, iſſues, ſetons, and ſtrong purging of the bowels.

Theſe artifices were conſtantly uſed by the wiſeſt ancients, as appears from the monuments which they have left us. Hippocrates, in treating on a quinſy, ſays, *In thoſe who are thus affected, blood is to be drawn from the veins of the arms, and at the ſame time the bowels are to be looſened or cleanſed, in order to draw off the matter which cauſes the diſeaſe,* [c] *&c.* And thus Galen recommends a revulſion, where he treats of curing the head-ach: *A revulſion is to be made in the whole body by ſharp clyſters, ligatures, and repeated frictions upon the lower parts; and alſo by taking away ſome blood, when that ſhall be found neceſſary. But in the mean time, whi-*

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[c] Sic affectis a venis, quæ in brachiis ſunt, ſanguis detrahendus eſt ſimulque alvus ſubducenda; ut, quod morbum exhibet, id avellatur &c. *De Locis in Homine, cap.* 11. *Charter. Tom. VII. p.* 370.

the general revulsion is procuring, we give a partial relief by the aspersion of those things upon the head which have a repelling force [d]. There are many more passages of the like nature which occur in the same authors; from whence it appears, that they had much confidence in revulsions towards the cure of many diseases. Helmont, who opposes the ancients almost in every thing, laughs at these trifles of revulsions; and, even since the time of Harvey, many have refused their assistance, as being either useless, or repugnant to the known circulation of the blood. But the use of revulsions in diseases is confirmed by daily experience, as well as by reason; for so soon as the resistance to the blood's motion is either diminished or totally removed in any part of the body, it immediately flows or is derived into that part with a greater velocity. Thus if an artery even but of a moderate size be divided, all the blood will flow through that vessel which does not resist. When all the vessels and viscera of the abdomen are suddenly freed from a considerable pressure by the birth of an infant, all the blood is frequently derived into those vessels so forcibly, that unless the flaccid vessels and viscera are compressed by swathing with a roller, the woman may suddenly perish in a fatal swoon for want of the blood's due pressure in the vessels of the brain and cerebellum. The same thing also happens, if the abdomen is not swathed, when all the water is discharged at once by paracentesis in a dropsy. It is therefore evident, that, by diminishing the resistance in any part of the body, the blood will be derived thither more forcibly and plentifully. But the fulness of the vessels, and the strength of their coats, resist the impulse of the blood from the heart; which conditions are impediments to their dilatation: Every thing therefore which lessens the fulness of the vessels, or occasions their sides to yield more easily to the distending

d Revulsionem in totum corpus acribus clysmatibus, et vinculis, ac multis internarum partium frictionibus; sanguinis etiam nonnihil, si ita necessitas urgeat, detrahendo. Parti autem medemur, interim dum in totum corpus revellimus, ea capiti inspergentes, quæ repellendi vim obtinent, &c. *Meth. Med. ad Glaucon. lib.* i. *cap.* 16. *Charter. Tom. X. p.* 364.

blood, will derive the humours more powerfully and copiously into that part. If again we consider, that the blood propelled by the heart is sent partly upwards to the head and superior parts of the trunk, and partly downward to the lower extremities and viscera; it will be from hence evident, that by diminishing the resistance of the lower vessels, or by evacuating them, the quantity and impulse of the blood will then be derived more towards the inferior parts, and drawn from those which are superior. It is therefore possible to make a revulsion of the arterial blood from an inflamed part to any other; especially when the part, towards which the revulsion is made, receives its blood from the same common trunks or larger arteries. Thus physicians foment the external parts of the head in inflammatory disorders of the encephalon, that the impulse of the blood being increased in the branches of the external carotid, it may urge with a less force upon the parts contained in the head. When the callus of a fractured bone is too luxuriant, (see the commentary on §. 357.) Celsus tells us, that it will be of some service to apply a fig and mustard to the opposite limb, till it has corroded the same in a small degree, and drawn thither the matter. Now all revulsives either relax the vessels, or empty them, by friction, or a more frequent contraction excited in the vessels by the application of things which stimulate upon the part towards which the revulsion is to be made. A revulsion, then, is procured chiefly by the following means:

By suction.] Which is best of all made with cupping-glasses; by the use of which the pressure of the atmosphere is removed from the part of the skin to which they are applied, or at least its pressure is by that means considerably diminished, whether the air be drawn out by sucking or by the air-pump, or by much rarefying and expelling a great part of the air contained in the cupping-glass by burning flax. So soon as the equable pressure of the air is taken off from the surface of the skin under the glass, all the vessels are more distended; the part swells, and looks red; and, if the glasses are continued for any considerable time,

time, a true inflammation may follow, or even a gangrene. Galen [e] has long ago obſerved, that pains are eaſed almoſt as with a charm, by making a revulſion with cupping-glaſſes. Hippocrates [f] has ordered the application of a very large cupping-glaſs to the breaſt, to leſſen the menſtrual flux. And I have ſeen violent inflammations of the eyes cured barely by the application of cupping-glaſſes, when ſcarce any other remedies would take the leaſt effect. And of what conſiderable uſe cupping was in the like diſeaſes among the Egyptians, may be ſeen in Proſper Alpinus [g].

By friction.] By friction the veins, as yielding more eaſily to preſſure, are more eſpecially emptied; whence the arteries, which correſpond to thoſe veins, will more eaſily diſcharge their blood into the emptied veins; therefore the reſiſtance of the blood flowing into thoſe arteries will be diminiſhed; whence it will be derived thither with a greater impetus and in a greater quantity, as is evident from what has been ſaid before. For this reaſon, any part of the body may, by friction only, grow hot, red, and become inflamed; and if the friction is continued, the increaſe of the blood's heat and motion will be communicated throughout the whole body: and for this reaſon Celſus condemns friction long continued in acute diſeaſes, ſaying, it is neither proper in them, nor in thoſe which are increaſing, becauſe it induces both a phrenzy and a ſleepineſs [h]. And a little after, ſpeaking of the uſe of friction, he ſays, *For friction alſo eaſes inveterate head-achs, but it is not to be applied when the pain is moſt ſevere: and a paralytic or weak limb becomes ſtronger by a friction of it. But when one part aches, it is much more uſual to make the friction upon another part more remote, and eſpecially when we intend to call off the morbific matter from the upper or from the middle parts of the body, for in that caſe we make frictions upon the extremities* [i].

e Meth. Med. lib. xii. cap ult. Charter. Tom. X. p. 292.

f Sect. v. Aphor. 50. Charter. Tom. IX. p. 224.

g De Medicina Ægypt. lib. ii. cap. 14. h Lib. ii. cap. 14. p. 89.

i Nam et capitis longos dolores ipſius frictio levat; non in impetu tamen doloris: et membrum aliquod reſolutum ipſius frictione confirmatur.

Synapiſms or epiſpaſtics :] Remedies ſo called from their drawing power; becauſe they derive the humours in a greater quantity, and with more force, into the parts to which they are applied. Now, although every thing which relaxes and weakens the veſſels in any part of the body may be termed *attractives*, becauſe a relaxation of the veſſels gives a more eaſy entrance to the humours; yet by this name we generally underſtand thoſe topical remedies which irritate the veſſels of the part to which they are applied by an acrid ſtimulus, ſo as to make them contract more frequently and more powerfully; that is, they accelerate the motion of the vital humours through their veſſels. Theſe attractive remedies have received various denominations, according as they poſſeſs a greater or leſs acrimony. Thoſe which only excite a redneſs in the part to which they are applied, are termed *phænigmi*; but if they excite a great redneſs, with heat, itching, and a tumour in the part, they are uſually called *ſynapiſms*, becauſe ground muſtard-ſeed, being applied to any part of the body, produces all thoſe appearances: if they are yet more acrimonious, and raiſe the cuticle into bliſters, they are then called *veſicatories*; or if again they produce the effects of fire upon the part by their ſtrength, they are termed *cauſtics*. All theſe excite a true inflammation in the part to which they are applied; and if they are very ſtrong, they may increaſe that inflammation even into a gangrene. But what efficacy all theſe have to derive the impetus of the blood towards other parts, is taught by daily obſervation and practice. If the feet of a perſon, who is ill with an acute phrenzy, be involved in a paſte made with ground muſtard-ſeed, ſcrapings of horſe-radiſh, or the like, the diſorder will frequently be relieved in a few hours, and the patient will begin to come to his ſenſes by the pain and inflammation thus produced. When nature endeavours to ſeparate any offenſive matter from the whole maſs of blood, and to depoſit it upon ſome particular part of the body, phyſicians then uſually

tur. Longe tamen ſæpius aliud perfricandum eſt, cum aliud dolet: maximeque cum a ſummis, aut a mediis partibus corporis materiam evocare volumus; ideoque extremas partes perfricamus. *Ibid.*

ıſually determine the wandering matter towards a part where it will be the leaſt offenſive, by applying *epiſpaſtics*; and this they do often with very good ſucceſs. Thus in the ſmall-pox, when the legs and feet have been fomented with emollient decoctions in the beginning of the diſeaſe, and theſe epiſpaſtics afterwards applied to the ſoles of the feet, I have frequently ſeen, that the puſtules have gathered extremely thick in the lower parts of the body, when at the ſame time there were but very few eruptions in the face and upper limbs.

Veſicatories.] Theſe, as we ſaid before, are yet ſtronger than epiſpaſtics; and ſeparate the cuticle from the ſkin of the part to which they are applied, raiſing it into bliſters diſtended with a thin liquor, whence they derive their name. Every thing which can excite the moſt violent inflammation are alſo *veſicatories*; for when an inflammation turns to a gangrene, theſe little bliſters of the cuticle afford almoſt the firſt ſign of the incipient gangrene: and in the ſame manner actual fire raiſes the cuticle into bliſters. Hence the moſt acrimonious remedies, ſuch as the ranunculi praenſes, hydropiper, ſedum minus acre, *&c.* being either applied in too great a quantity, or continued too long upon the part, raiſe bliſters in the ſkin. But of all this tribe of remedies, cantharides are the moſt frequently in uſe; which dry and juiceleſs inſect I have known to retain its force of bliſtering, though kept in a glaſs negligently ſtopped for the ſpace of above thirty years. Cantharides, groſsly pulverized, and mixed with ſome ſticking plaiſter, or with ſome dough of which they make bread, and applied to the part towards which the revulſion is to be made, are ſuffered to continue there for the ſpace of eight or ten hours, within which time they uſually elevate the cuticle into a bliſter. But if the cantharides are left too long upon the part, they often excite intolerable pains, by irritating that nervous pulp which lies immediately under the cuticle; and ſometimes they even excite a ſevere ſtrangury and bloody urine.

But as all theſe things have a powerful acrimony, and frequently increaſe the velocity of the blood through-

throughout the whole body, by irritating the part to which they are applied, (which yet is a circumſtance repugnant to the indication in this caſe, as is evident from n° 2. in this aphoriſm), therefore great caution is always neceſſary in the uſe of them.

Fomentations and warm bathing.] Theſe are uſually compoſed of water, with the addition of ſuch things as are emollient or relaxing. And all of them act by relaxing the ſolids, ſo as to diminiſh the reſiſtance of the veſſels, whereby they will be more eaſily dilated even though the diſtending cauſe remains the ſame. The moſt efficacious of all theſe are baths of warm vapours; for any part of the body, if expoſed for a quarter of an hour to the vapours of warm water only, will begin to ſwell. But when a revulſion is to be made towards a part of the body which cannot be conveniently immerged in the bath, fomentations may then ſuffice, provided they are retained warm.

Iſſues.] The ſkin is here divided with a lancet down to the panniculus adipoſus, or elſe corroded by the potential cautery in thoſe who are afraid of the knife. The wound thus made is filled with a little ball of gold, ſilver, ivory, or any other matter which is not eaſily changed; and then covered with a ſticking plaiſter, to prevent the globule from ſlipping out of the wound. Thus a foreign body, being interpoſed betwixt the lips of the wound, prevents their concretion; and at the ſame time a ſlight contuſion and irritation are made throughout the whole compaſs of the wound by the hard body, which makes a daily ſlight inflammation in the part, towards which the impulſe of the arterial blood muſt be therefore derived. Theſe iſſues are chiefly ſerviceable to thoſe patients who have their ſolids ſo weak or flexible, that the leaſt exceſs of the blood's impetus dilates their veſſels, which permit the groſſer parts of the blood to miſtake their courſe. Thus, for inſtance, thoſe who have an inflammation of their eyes upon every ſlight occaſion, are very frequently relieved by iſſues. But when a violent inflammation ſuddenly invades any part, it is evident enough that iſſues will be uſeleſs; for the part affected may be

long

ong corrupted by a gangrene before iſſues can be ſup-
oſed to produce any effect. The ſame is alſo true of
Setons.] Theſe are generally placed in the nape of
he neck, where the ſkin and panniculus adipoſus be-
ng taken up with a pair of plyers for the purpoſe,
he ſurgeon perforates them with a large needle, arm-
d with a large thread, which he leaves in the wound,
nd which being daily drawn through the wound, ir-
itates and excites a continual inflammation in the
art. Theſe are of the ſame uſe with iſſues; but they
enerally have a more conſiderable effect, as they pro-
uce a greater pain and irritation. I have ſeen the
moſt obſtinate head-achs cured by the revulſion which
ſeton makes, when they have proved inflexible to
ll other remedies; and there are many inſtances
vhich occur in the beſt authors confirming the ſame
hing. We have a remarkable caſe of this nature re-
ted by Ruyſch [k], of a girl eighteen years old, of a
anguine habit, who was continually tormented with
n intolerable head-ach. The moſt efficacious reme-
ies uſual in theſe caſes were tried without ſucceſs,
uch as purging, repeated phlebotomy, bliſters, ſter-
utatories, cupping-glaſſes. Even a large wound had
een made in the integuments of the head by a cru-
ial inciſion, which was attended with a conſiderable
æmorrhage; but without ſucceſs, inſomuch that ſome
minent ſurgeons had thoughts of trepanning the cra-
ium. But before they proceeded to this laſt and ſe-
ere remedy, Ruyſch propoſed the application of a ſe-
on; which being made, the pain preſently vaniſhed.
he patient, however, being tired with its trouble-
omeneſs, took out the thread; whereupon the pain,
vhich had been hitherto dormant, again revived: but
new ſeton being made, it preſently diſappeared.
nd even a third time, the ſeton being taken away,
ne moſt troubleſome head ach returned; but again
ielded to a new ſeton.

Strong purging.] How ſerviceable it is in inflamma-
ory diſeaſes to diminiſh the quantity and impulſe of
ne humours by purging, and what purges are proper
for

[k] Obſerv. Chirurg. obſ. 40. p. 39.

for that purpose, has been already declared at n° 2 of this aphorism. But it is to be observed, that the same evacuation may be likewise useful as a revulsion, to derive the impetus of the blood from an inflamed part, especially when the disorder is seated in the upper part of the body. For so powerful a derivation may be made through the mesenteric vessels towards the cavity of the intestines, that there will hardly remain any pressure of blood in the vessels towards the encephalon; insomuch that the stronger purges frequently occasion a vertigo, and even fainting. When the whole tunica adnata looks red in an ophthalmia, by the entrance of the red blood into the smaller vessels; in that case, by giving a strong purge, the blood is repelled back into the larger vessels, while a paleness invades the face and eyes, whence a speedy and happy cure is frequently made. Clysters frequently thrown into the bowels do often produce the same effect, partly by relaxing the vessels, and partly by deriving the impetus of the humours that way by a gentle stimulus. Hippocrates treating on the cure of a pain in the ear, after having ordered the application of cupping-glasses on the opposite part, to turn off the afflux, says, *If these avail nothing, a medicine is to be given which will purge downward; but by no means one that will evacuate upward, since vomiting is here prejudicial,* [1] &c. And a little after, treating of an ophthalmia, he adds, *If the eyes are suddenly taken with an inflammation, do not anoint them with any thing at all; but make a powerful cauterization in the lower parts, or reduce the habit by giving some medicine that will purge the bowels, taking care not to make the patient vomit* [m]. From whence it is evident that the ancient physicians used purges, to make a revulsion from inflamed parts; and that the purges were of such a nature as to act strongly; since Hippocrate-

it

[1] Si hæc nihil juvent, medicamentum propinandum sit, quod deorsum purget; sursum vero minime, cum vomitus nihil conferat, &c. *De Locis in Homine. cap. 6. Charter. Tom. VII. p. 364.*

[m] Si subitissime (oculi) inflammationem conceperint, nihil omnino illine; sed vel fortissime in inferioribus partibus inunito; vel alio quopiam alvum ducente medicamento extenuato; cavendo ne vomitum facias. *Ibid.*

n this place uſes a term which denotes an extenuation or waſting of the body, and a collapſion of the veſſels, by a powerful evacuation. But he orders vomiting to be induſtriouſly avoided in theſe caſes; becauſe, in the act of vomiting, the blood is derived more plentifully and violently towards the head: as is apparent, if a perſon looks at a man while he is vomiting; for the eyes look red and watery, and the lips and whole face are diſtended and ſwelled with blood, *&c.*

5. By a dry and cool air; by keeping the affections of the mind either ſilent or very ſedate; by procuring a natural or artificial reſt to the patient; by uſing a thin, fluid, and cooling diet, with a drink of the like nature, and uſing diluent and cooling medicines at the ſame time.

This number treats of thoſe means by which the motion of the humours thro' their veſſels may be rendered moſt ſedate, in order to hinder any further hurt from being done to the veſſels which are inflamed.

A cool and dry air.] That is, cool ſo far as it is received into the lungs in reſpiration. For the blood propelled from the right ventricle of the heart receives a great heat and attrition from the ſwiftneſs of its motion through the pulmonary artery; and therefore requires to be cooled by the air, as is evident from phyſiology. But if the external air is too hot, it cannot be then expected to cool the blood. Now it appears, from experiments made on living animals, that a moſt acute fever may ariſe, barely for want of this cooling of the blood by the air, which proves fatal in a few minutes time, if the air in which thoſe animals are included is very hot [n]. It is therefore evident, that a cool air conduces much to moderate the ſwiftneſs of the circulation of the blood. But a dry air is to be preferred (*cæteris paribus*) before a moiſt air; which laſt, if cold, may cool the blood too much. For we conſtantly obſerve, that people are ſenſible of a greater cold in autumn or winter, when the air is moiſt, than when it is dry,

[n] H. Boerhaave Chem. Tom. I. p. 275, &c.

dry, notwithstanding the thermometer denotes the same degree of heat; which seems to follow, because the ambient air is sooner heated by the warmth of our bodies when it is dry or has but little moisture: for, in general, it is to be observed, that bodies grow hot sooner or later by the same degree of fire, in proportion as they are more or less dense, whether they be solids or fluids [o].

The affections of the mind either silent or sedate.] That the circulating motion of the blood may be very much accelerated by violent passions of the mind, is evident from daily and certain experience. But of this subject we treated in §. 99, n° 1. Whence it is evident, that these passions ought to be industriously avoided: or if they should arise, they are to be immediately quieted; as to the manner of effecting which, see the commentary on §. 104.

By procuring natural or artificial rest.] How serviceable rest is in all diseases in which there is too great a velocity in the blood's motion, has been said in the commentary on §. 105. When the mind is not discomposed by any passions, and nothing operates strongly upon any of the sensitive organs, a quiet sleep then usually creeps on of its own accord; for which end, in all acute and inflammatory diseases, the ancient physicians caused their patients to lie in a dark place free from the least noise. But if rest cannot be thus procured, after premising those means mentioned in the preceding numbers, we may then safely apply to the use of anodynes. See more concerning these remedies in the commentaries on §. 202. and §. 229, n° 2.

A thin, fluid, and cooling diet.] In order to restore those parts which are continually wasted from the body by the unavoidable actions of life and health, it is required that we be continually taking in aliments at proper intervals; and though these aliments are of the best nature which we can chuse, yet they have always something of a foreign disposition, and therefore require to be altered into our own nature by the action of the vessels and viscera. But while this attenuation and change is made in our ingested aliments, if they are taken

[o] Ibid. p. 279.

aken either in too large a quantity, or are not eaſily ſuſceptible of that change, they excite a fever even in he moſt healthy people; by which means the inflexi-ble matter which produced the fever is either attenua-ed or diſcharged. Even every day the moſt healthy erſon may perceive an increaſe in the quickneſs of the ulſe, ſome hours after dinner. Now, the weaker thoſe owers are which are to change the crude aliments in-o good blood, ſo much more is the blood's motion ac-elerated by the ingeſted aliments. Thus if a weak irl ſhould have dined upon fleſh that has been dried n the ſmoke, upon fat bacon, or food of the like hard igeſtion, ſhe will certainly be feveriſh within a few ours afterwards: and phthiſical people who are gra-ually waſted by an hectic fever, even theſe perceive n increaſe of their fever by taking more milk than u-ual. But as the aſſimilation of the ingeſted aliments nto healthy animal-juices depends chiefly upon the ction of the ſolids upon the fluids, and upon a conſi-erable quantity of healthy ready-formed juices, which re to be gradually mixed by a little at a time with the rude chyle, (ſee the commentary on §. 25); and as by eeding and purging (preſcribed at n° 2 and 3 of this horiſm for reſolving an inflammation) the ready-for-ed or concocted humours are evacuated, and the force f the circulation diminiſhed; it is therefore evident, at the diet ought to conſiſt of ſuch things only as e very eaſily attenuated and digeſted. Every thing erefore which can be eaſily changed into good chyle, ren by a ſlight action of the chylificative viſcera, and ay be afterwards eaſily attenuated further, ſo as to rm good blood, by the action of the lungs and arte-es, will be here convenient: as, the whey of milk, pecially that ſouriſh kind which is made from butter-ilk; milk diluted with two or three times as much ater; barley or oat gruel, *&c.* with the juices new-expreſſed from garden fruits. Theſe are in this caſe ry uſeful, eſpecially if taken in ſmall quantities at a ne, and frequently repeated: for by ſuch a diet the dy will never be oppreſſed, but will from thence be derately cooled, which is extremely beneficial in a-

cute inflammatory diſeaſes. People have even a ſpontaneous or natural appetite to ſuch cooling and thin aliments, when they are fatigued either with inflammatory diſeaſes, or by the intenſe ſummer's heat; and they have an averſion to food of a contrary nature: but, on the other hand, a cooling diet would be directly repugnant in the winter-time for chronical and languid diſeaſes. And this doctrine we have expreſſed by Hippocrates, after his uſual manner, in a very few words, when he ſays: *That the weak are to have cooling diet, but the ſtrong and healthy a diet that is heating* [p].

Drink of the like nature.] The juice of citrons, oranges, cherries, currants, or their ſyrups or inſpiſſated juices which are prepared by the confectioners, diluted with a large quantity of water, form a very pleaſant drink; out of which you may make an agreeable variety, changing the ingredients, and ſelecting thoſe which are moſt pleaſing to the patient, ſince almoſt any thin liquor will ſuffice for this purpoſe.

Uſing medicines which dilute and cool at the ſame time.] We have already ſeen, that the impervious blood ſtagnating in the ſmaller veſſels, ſuffers a compreſſion and attrition from the impulſe of the humours urging behind, as is evident from the definition of an inflammation given in §. 371; and we demonſtrated in §. 382, no 6. that this attrition is followed with an intenſe heat. Therefore, to prevent any farther injury to the inflamed veſſels, it will be convenient to uſe ſuch remedies as may diſſolve the obſtructing or concreted matter by diluting, and at the ſame time remove the too great heat which ariſes. But, properly ſpeaking, we have in this caſe but one diluent; namely, water; ſince all other medicines are no farther diluents than as they contain water. But we ſaid a little before, that thin and fluid aliments, or rather drinks, are here convenient; that is, as they contain more water by which they conduce to dilution together with the medicines. Cooling medicines, again, are ſuch as diminiſh or remove the cauſes of too great heat; which too

[p] Imbecilles dietæ frigidæ, valentes vero calidæ. *Epidem. lib.* vi *textu* 18. *Charter. Tom.* IX. p. 494.

too great heat, accompanying an inflammation, was demonstrated (in §. 382. nº 6, 8.) to arise from a greater attrition of the solids and fluids upon each other, from an increase of the circulation in the inflamed vessels, as also in those vessels which remain yet pervious, but are more or less compressed or straitened by the distension of the adjacent vessels which are obstructed and distended. Therefore every medicine will be a cooler, which can remove the too great thickness of the fluids, which can relax the obstructed vessels, and which can diminish the too great impetus of the circulation; and therefore all watery liquors will be serviceable not only as diluents, but as coolers at the same time. For we observe that the habit of body is colder as it contains a larger quantity of water; and, on the contrary, that the blood is hotter as it is less dilute: Hence all dropsical people are cold; but those who are robust, and addicted to exercise, are very warm. But water is also serviceable at the same time, in as much as it relaxes the solid parts, as was said in the commentaries on §. 35 and 54. Now the blood being diluted with water, and the vessels relaxed, the force of the circulation is thereby always diminished; as is very evident in weak girls, who so frequently fall into diseases from weakness by the abuse of warm watery liquors. When therefore there are any hopes of resolving an inflammation, water is to be the basis of all the antiphlogistic medicines; to which farinaceous and emollient substances are to be added, to relax the vessels still more; and to these, attenuating remedies are likewise to be joined, to divide the inflammatory concretions, and render them pervious. Various forms of these remedies may be composed, of which you have some specimens given in the Materia Medica corresponding to this number of the present aphorism. It is to be also observed, that bleeding and purging, of which we treated at nº 2, 3, of the present aphorism, are also coolers in inflammatory diseases.

6. By quieting the impetus of the blood in the part itself by the external application of reme-

dies which cool, repel, and aſtringe; to which may be added anodynes and aperients of various kinds, according to particular circumſtances.

Hitherto we have been treating of thoſe remedies which prevent any further injury of the veſſels, either by making a change in the whole body, or in ſome of its parts: We come now to treat of thoſe which are capable of reſtraining the too great impetus of the humours, by an external application to the inflamed part itſelf. It was ſaid before, in the commentary on §. 382, n° 8. that by an irritation of the fibres in the inflamed part, the motion of the humours was accelerated as well in the affected part as throughout the whole body; and therefore every thing which can remove this irritation by being applied to the inflamed part, will reſtrain the impetus of the blood. Now this irritation ariſes from the ſides of the veſſels being diſtracted by the blood urging behind the obſtructions; and therefore every thing which can remove the obſtructions, and give a free paſſage to the heſitating blood into the open veſſels, may remove this irritation. Such a paſſage may be procured two ways: either by ſo relaxing the obſtructed veſſels, that the impervious particles may paſs through the extremities into the veins; or elſe by contracting the veſſels in ſuch a manner by things which cool, repel, and aſtringe, as to drive back the obſtructing matter from the impervious ends of the veſſels towards their larger baſes, or into a larger part of thoſe veſſels. This laſt method was frequently uſed by the ancient phyſicians, when any part of the body was ſuddenly inflamed, without any apparent cauſe preceding; in which caſe they derived the cauſe of the diſorder from an afflux of humours. And Galen [q], treating of this diſorder, obſerves, that the methodical ſect of phyſicians and their followers aſſerted, that all inflammations were to be treated with laxatives, becauſe they judged the diſorder to proceed from an

[q] Method. Medend. ad Glaucon. lib. ii. cap. 2. Charter. Tom. X. p. 370.

an aſtriction: For it is to be obſerved, that this ſect of phyſicians derived all diſorders either from a ſtricture, or a relaxation of the ſolids; in which doctrine they had afterwards many followers. But a little afterwards Galen adds, that both reaſon and experience teach, that, after due evacuations, the inflamed part is to be treated with ſuch remedies as have a power of repelling the influent humours, and at the ſame time of evacuating thoſe which are already contained in the affected part, and ſuch alſo as can reſtore the tone or ſtrength to the affected parts. For theſe purpoſes he recommends the ſempervivum, malicorium, rhus, *&c.* in which there is manifeſtly a power of cooling and aſtringing. And in the following chapter of the ſame book, he ſays, that it will not be improper to apply ſuch things as moiſten and warm, to thoſe inflammations which ariſe from other cauſes, but which do not proceed ſuddenly from ſuch an afflux.

From what has been ſaid therefore here, and in the commentary on §. 390, where we treated of the effects following from the application of things actually or potentially cold to an inflamed part, it appears, that coolers, with aſtringents and repellents, are ſerviceable only at ſome particular times; and that there is ſome caution required in their application, ſince, if they do not prove of ſervice, they may be very prejudicial. In the ſlighter inflammations they are often very beneficial, if applied in the beginning; and thus I have frequently ſeen incipient inflammations of the eyes cured by the mere application of cold water. But when the diſorder is inveterate, and the obſtructing matter as it were (to uſe the expreſſion of Galen, cited in §. 390.) *wedged* into the veſſels, it will not then ſuffer itſelf to be eaſily repelled; ſo that here theſe remedies, by contracting the veſſels and coagulating their humours, would rather increaſe the diſorder: in ſuch a caſe, therefore, laxatives and aperients will be more properly applied, to open the veſſels and looſen the obſtructing matter. It is therefore the buſineſs of a prudent phyſician to vary and chuſe his remedies according to particular circumſtances.

It likewiſe ſeems of ſervice in this caſe to take in the uſe of anodynes, or thoſe medicines which eaſe pain. Theſe, as we obſerved in the commentary on §. 202, act in a threefold manner: either by removing the cauſe of the pain; or by ſo diſpoſing the pained part to which they are applied, that it becomes leſs affected by the painful cauſe; or by removing the ſenſe of pain, while the cauſe of it remains in the injured part. All the remedies therefore before mentioned will be anodynes, inaſmuch as they remove the cauſes of pain, either by relaxing and opening the obſtructed veſſels, or by repelling the impervious matter from the narrower towards the larger part of the veſſels, or by ſo diſpoſing the affected part as that it will be leſs injured by theſe cauſes. But, beſides theſe, we have alſo a licence to uſe thoſe remedies which remove the ſenſe of pain in the part to which they are applied, provided the means capable of removing the cauſes of the pain be not at the ſame time neglected. Hence the leaves of hyoſciamus, cynogloſſæ, *&c.* may be added to fomentations to be applied to the inflamed parts: for the effects of violent pain are (as we obſerved at §. 226.) fever, heat, thirſt, dryneſs, *&c.* all which are hurtful to the inflamed parts; and as many of theſe diſorders ariſe only from the ſenſe of the pain, (§. 229, n° 2.) it is very evident that much good may be expected from the uſe of thoſe remedies by which that ſenſe is obtunded.

§. 397. THE injury itſelf, which is done to the veſſels, is likewiſe removed by the ſame means (396): for thoſe which have been relaxed by too great a diſtraction will recover their former figure by the natural contractile force of the fibres, and their powers and nutrition will return.

The injury ſuſtained by the obſtructed veſſels aroſe from their diſtenſion by the impulſe of the vital humours urging upon the obſtructed part; and as every thing

thing enumerated in the preceding aphorism tends either to diminish or to turn off the impulse of the blood, it is very evident that the injury may be removed by the same means. For so long as there are any hopes of obtaining a resolution, the continuity of the vessels is not yet dissolved, even though they are very much distracted: so that, when the obstruction is resolved, the distracted fibres gradually recover their former dimensions; and all the disorder which then remains, is a weakness of the fibres from their having suffered too great a distraction, (see §. 25, n° 3.) which is cured by removing the distracting causes, (§. 28, n° 5.) and by restoring the lost strength of the vessels and viscera by suitable aliments. Now the more firm and elastic the vessels are, which have been distended by an inflammation, the sooner do they return to their former shape or dimensions; and, on the contrary, more time is required to restore the strength of the vessels in proportion as the inflammation is seated in a lesser series of them. Perhaps one may from hence derive the reason of several appearances, which remain a long time after the cure of inflammatory diseases of the encephalon by resolution: for it sometimes happens, after a frenzy or a delirium in acute fevers, the small-pox, *&c.* that a considerable weakness remains, or a notable disturbance of all or some of the functions depending upon the encephalon, even after these diseases have been cured. If then the cure of them is attempted by blisters, purges, sudorifics, and the like evacuants or powerful movers of the blood, every thing becomes worse; whereas, by committing them to nature, those maladies in time disappear of themselves. The same thing is also confirmed by that most diligent observer of nature in the most abstruse diseases, Sydenham[a]: for he remarks in a continual epidemic fever, which suddenly affected the head with a frenzy, that, after general evacuations made by bleeding and purging, a coma was sometimes left behind; which yet disappeared in time, provided the patient arose from his bed daily, and was not molested with violent remedies. For

[a] Schedula Monit. de novæ febris ingressu, p. 661.

For, in theſe caſes, the equable motion of the humours through the encephalon ſeems to remain diſturbed, till the veſſels, too much weakened by diſtenſion, have recovered their former ſtrength.

§. 398. THE obſtructing matter will be reduced to a ſtate of fluidity, if it be attenuated and diluted:

1. By reſtoring the elaſtic vibrations of the veſſels, by diminiſhing the diſtending humours by plentiful bleeding and purging; by adding a ſtimulus to the fibres, by means of ſome thin aromatic liquor drank very warm; by fomentations, frictions, cuppings, and ſcarifications.

The third thing required in the cure of an inflammation by reſolution, was to add and preſerve a fluid ſtate to the obſtructing matter, (ſee §. 395.) We therefore now come to treat of the methods and remedies for obtaining theſe ends; and firſt concerning thoſe by which the impervious matter is rendered ſo fluid as to paſs freely through the narrow extremities of the veſſels. But this may be obtained two ways: either by diluting, as when the combined particles of the blood are ſeparated by the interpoſition of water; or elſe by attenuating the matter, by the attrition of the veſſels with frictions, and ſuch remedies as by the figure and rigidity of their particles may be capable of dividing the concreted parts. Alſo diluents and attenuants may be ſo combined as to produce greater effects by their conjunct powers.

1. Our blood naturally tends to concretion by reſt, and this the more as the perſon is ſtronger: a continual motion is therefore neceſſary, to alter the ſituation of the particles of the blood, and prevent their concretion; and it is by this ſame motion that thoſe parts are to be diſſolved which have once begun to concrete. When a perſon faints away, the blood ſtagnates in the large venous receptacles about the heart; and eſpecially a large quantity is collected in the venous ſinus

and

nd right auricle of the heart, and betwixt the lungs, vhere it begins immediately to be diſpoſed to concre- ion. But if ſuch a perſon is revived by the aſperſion of cold water, immediately a violent palpitation of the eart follows; and the viſcid blood, which began al- noſt to form a polypous concretion, will ſtagnate in he ſmall extremities of the pulmonary artery; but, pon the contraction of that artery, theſe fleecy con- retions will be repelled; and thus will they return ackward and forward, till they are at length attenua- ed and diſſolved by the attrition from the ſides of the eſſel; and thereupon all the anguiſh ceaſes, and the lood has again its free courſe from the right ven- ricle through the narrow extremities of the pulmonary rtery. The ſame effect may be expected if the in- amed veſſels are reſtored to their elaſtic vibrations with vhich they before moved. For if we conſider the cau- es by which our blood is moved in the veſſels in a ſtate f health, it will appear, that that oſcillatory motion by vhich they are alternately dilated and contracted muſt e deficient in a veſſel that is inflamed. For when he heart contracts, it expels all the blood contained n its cavities into the arteries, which are already full; nd which, being flexible, will be therefore dilated at ne inſtant when the heart is in its contraction; after vhich the arteries will again contract to their former di- meter, by the elaſticity and re-action of their muſcu- ar fibres, by which the blood contained in their cavi- es will be propelled forward; for the valves, placed t the entrance of the aorta, prevent the blood from re- urning back towards the heart, and therefore it is de- ived through the arteries into the veins. If, now, ve conceive an obſtacle to be lodged in the cavity of an rtery, ſo as to prevent the free courſe of its blood, that rtery may be dilated by the impulſe of the blood recei- ed from the force of the heart; but cannot contract tſelf again the moment after it has been dilated, be- auſe the paſſage of its contained blood into the veins s obſtructed, and the return of it is alſo prevented by he impulſe of the blood urging behind: ſuch an artery vill therefore remain full and diſtended; but without motion,

motion, becauſe the elaſticity and force of its coats are not ſufficient to remove the reſiſtances. But how can we here reſtore the vibration of ſuch an artery? It may be done barely by diminiſhing the quantity of the diſtending humour. But the obſtructed end of the artery denies a paſſage into the vein: The only method remaining, therefore, to diminiſh the quantity and force of the vital fluids to ſuch a degree, that the natural contraction of the artery may be ſufficient to prevail, and by that means repel the contained blood towards the baſis of the artery. Then the obſtructing matter, being no longer preſſed by the fluids urging behind, will paſs, by the contraction of the artery, towards the baſis of that veſſel, unleſs it was ſo impacted in the narrow extremities as to be quite immoveable; and again, the moment after, it will be propelled to its former ſituation in the narrow extremities; from whence an attenuation and diviſion of the concreted particles may be reaſonably expected. And that the concreted blood may thus diſſolve into leſſer particles, ſo as to be capable of paſſing through the narrow extremities of the arteries, has been demonſtrated to the eye, in the experiment of Leeuwenhoeck, which we mentioned in the commentary on §. 232, no 1. But in what manner the quantity and impetus of the diſtending fluids may be diminiſhed by bleeding and purging, has been declared before at no 2 and 3, under the preceding aphoriſm. And how much may thereby be done towards a reſtitution of the oſcillatory motion of the veſſels too much diſtended with fluids, is evident in plethoric patients: in whom the pulſe of the artery is often ſcarce perceptible when the plethhora has acquired its utmoſt extent; but, when the too great quantity of fluids is diminiſhed by a plentiful bleeding, the pulſe ſoon after riſes, and all the functions are reſtored which were before oppreſſed.

By a ſtimulus added to the fibres by means of a thin aromatic liquor drank very warm.] The celebrated Baglivi, in his treatiſe, *De fibra motrice et morboſa*, has demonſtrated, that there is a propenſity to irritation in the ſolid parts of our body by which they may be

be ſurpriſingly diſturbed from the irritation of ſtimuli, whether by increaſing their natural motion which they uſed to perform according to the laws of health, or by diſordering it. It appears from the moſt certain experiments, that ſtimuli produce this effect in the larger parts of the body. The ingeſted aliments are conveyed by degrees through the ſtomach, and all the convolutions of the inteſtines, till they arrive at the end of the inteſtinum rectum; and being in this long courſe drained of their more ſoluble parts, are at length diſcharged out of the body: but if the inteſtines are irritated by a ſtimulating purge, the ingeſted aliments will then be hurried through the bowels in a ſhort ſpace of time, with a conſiderable diſturbance from an increaſe of the periſtaltic motion. When acrid poiſons corrode the internal ſurface of the inteſtines, they often cauſe them to contract ſo violently, as to be quite ſhut up in all thoſe places where the poiſon touches; whence, the elaſtic air being intercepted, enormous tumours of the abdomen have been obſerved to follow. Even this irritability is ſo ſtrongly inherent in many parts of the body, that they retain it after death, and exert a motion thereby when all the other parts are dead. The obſervation of Lord Bacon, mentioned in the commentary to §. 1. informs us, that the heart of a man, who was exenterated, being thrown into the fire, leaped up to a conſiderable height, and continued its motion for the ſpace of ſeven or eight minutes. When Peyerus opened the thorax and abdomen of a cat, when ſhe was ſtiff and dead of an abortion; upon blowing into the receptacle of the chyle, he was ſurpriſed that the air paſſing to the heart occaſioned firſt its auricles, and then the whole heart, to vibrate for ſeveral hours. When the ſame anatomiſt happened to try the like experiment in human bodies, he found it had the ſame ſucceſs; yet ſo that the motion of the heart was more eaſily recalled in ſome than in others: and ſometimes he not only inflated air, which ought to be warm, but he alſo found it neceſſary to uſe an external warmth. He found by experiments, that the hearts of thoſe who had been hanged eaſily recovered their motion, and re-

tained

tained it for a more conſiderable time[a]. From all which it is apparent, that the application even of a ſlight ſtimulus to the fibres, viſcera, and veſſels, may excite them to greater motions. When the moſt healthy perſon has taken too large a quantity of ſalt, ſpices, or wine, the heart and arteries will be irritated by thoſe ſtimuli to more frequent contractions, and produce a fever. When therefore the obſtructed veſſels have been a long time conſiderably diſtended by the impulſe of the vital humours urging behind, their fibres are often ſo much diſtracted, that they loſe their force, and do not ſufficiently re-act upon their contained fluid. So ſoon therefore as the quantity and impetus of the diſtending blood has been diminiſhed by bleeding and purging, it will be proper to exhibit ſuch remedies, as, by mixing with the blood, and paſſing through the arteries, may irritate their fibres with a gentle ſtimulus, ſo as to contract with a greater force, and by that means break or divide the obſtructing particles ſmall enough to paſs eaſily through the extremities of the veſſels, whence the inflammation will be cured by a reſolution. But to anſwer this intention, the milder ſort of ſpices are uſed, drank by the way of infuſion in a large quantity of water; ſuch as the ligna ſantalorum, ſaſſafras, the five opening roots, *&c.* either infuſed or gently boiled, which can never be prejudicial in ſuch a caſe. Such a form may be ſeen in the Materia Medica correſponding to this aphoriſm.

But while theſe remedies are taken plentifully, it will be proper to determine their action towards the affected parts by fomenting, friction, cupping, and ſcarification; concerning the uſe of all which we treated in the commentary on §. 134. Frictions are particularly uſeful in this caſe, as they perfectly imitate and ſupply the action of the veſſels by contraction and relaxation upon their contained fluids. But it is very evident that the frictions are here required to be but gentle; and that they ought never to be uſed to inflamed parts, till the pain and tenſion have been leſſened or removed by evacuating and leſſening the impulſe of the blood.

2. By

[a] Peyer. Parerg. Anatom. p. 199.

2. By diluting the impacted matter, by drinking thin and watery liquors warm.

After a large quantity of the humours have been evacuated, and the veſſels reſtored to their vibrations, nothing will be more conducive to the cure of an inflammation by reſolution, than to fill the veſſels with ſuch a liquor as may eaſily pervade all the ſmaller veſſels. Such a fluid is water; and the moſt ſubtle parts of our humours, which come under our ſenſes, reſemble water almoſt in every reſpect: from whence it is evident, that water may paſs through even the ſmalleſt veſſels of the body. This fluid therefore, drank warm, is one of the chief remedies in all inflammatory diſeaſes: for being brought, by the laws of circulation, to thoſe parts where the obſtructions are formed, it will there inſinuate, dilute, and be intimately mixed with the obſtructing matter by the action of the veſſels; ſo that, by interpoſing itſelf betwixt the obſtructing particles, it will ſeparate them from each other, which we call *dilution*. But what power water has in removing obſtructions by diluting and attenuating, has been declared in the commentary to §. 134, 135. It is alſo to be obſerved, that water ſerves for a vehicle to all the other remedies which are capable of attenuating and diſſolving the inflammatory concretions: therefore all thin drinks in which water is predominant are fit for the ſame purpoſe; ſuch as the whey of milk, milk and water, mild ſmall-beer, decoctions of barley, oats, *&c.* and the infuſions of coffee and tea.

3. By uſing attenuants, reſolvents, and ſuch things as are oppoſite to the nature of the obſtructing matter, applied as well externally as internally, in the form of decoction, bath, fomentation, vapour, cataplaſm, emplaſter, or ointment.

Although water can diſſolve many concretes, ſuch as all ſalts, things ſaponaceous, mucous, and gelatinous; yet there are many things which water alone is not capable of diſſolving. For this reaſon, ſuch reme-

dies are mixed with water as are known to poſſeſs a diſſolving power; and of theſe ſuch are to be choſen as are oppoſite to the nature of the obſtructed matter. Now the obſtructing matter in this caſe is the red blood, or a thinner impervious humour joined with it, either ſtagnating in their proper veſſels, or wedged into other ſmaller veſſels by an error of place: at the ſame time, there is alſo a greater motion and heat, which incline our humours very much to a ſtate of putrefaction, (ſee §. 84. n° 4, 5.); and therefore the attenuators of the inflammatory concrete ought at the ſame time to be very averſe to putrefaction. We are acquainted with ſeveral remedies of this nature, in which there is not only a great power of attenuating and diſſolving, but alſo of reſtraining putrefaction. Honey poſſeſſes theſe qualities in a high degree, and was therefore very frequently uſed in all inflammatory diſorders: for, by an immoderate or too long uſe of this juice, the whole maſs of blood may be ſo diſſolved, as to be evacuated from the bowels under the form of water; and it alſo has the power of preſerving or confecting all parts of vegetables from any manner of corruption. Even Herodotus[b] tells us, that the Babylonians buried in honey. Sugar, which is at preſent ſo much in uſe, is endowed with the like efficacy: to theſe add the recent juices of garden fruits, the roots of ſuccory, goat-beard, vipers-graſs, *&c.* all which may be uſed with ſucceſs in the form of a thin decoction. Among the ſaline attenuants, nitre is to be preferred; becauſe the reſt are either alcaline, (ſee §. 135, n° 2.) and therefore diſpoſe our humours more to putrefaction; or elſe they ſo increaſe the impetus of the arterial blood by their ſtimulus, as to be not eaſily overcome by the action of the veſſels. Various forms of pleaſant medicines may be made with theſe ingredients for internal uſe; and it will be at the ſame time uſeful to apply the like medicines externally to the inflamed part, either in the form of a bath, fomentation, vapours, or cataplaſm. But the external application of theſe remedies ſeems to be not only uſeful, inaſmuch as the water, ſaturated with the

[b] Lib. i. p. 80.

the medicinal particles, insinuates itself through the bibulous veins of the skin, and, mixing with the blood, is by the laws of circulation carried throughout every part of the body; or else may be determined more to the inflamed part, by deriving with attractives or propulsives (§. 134.): But they also act with advantage, inasmuch as, being diluted with water, they insinuate into and through the arteries themselves, and by that means apply their force immediately to the obstructing matter. For that part of the artery which is beyond the obstruction remains empty, and is not urged by the impulse of the blood from the heart; and all the branches of such an artery, which arise beyond the obstruction, will be likewise empty: from whence that force, by which very small tubes attract liquors into their cavities, will cause the fluid medicine applied to enter those branches. If therefore the obstructing particles are plied on all sides by attenuants, as well externally as internally; and if the elastic vibrations of the vessels are likewise restored at the same time; it is evident, that the obstructing matter will be in a manner dissolved, provided there is but the least prospect of a mild resolution. But the plasters and ointments which are applied to the inflamed part with this intention ought not to be too adhesive, nor to have any considerable acrimony, because then they will rather increase the disorder; (see §. 376.) Such of these, therefore, are to be chosen, as only adhere gently to the skin, and confine the thin exhaling vapours, so as to retain the parts affected as it were in a vaporous bath of its own, and, by relaxing the bibulous veins, to suffer the particles of the applied remedies to enter more easily.

§. 399. THE humours are rendered mild or unacrid by watery drinks, a smooth diet, with mild or balsamic medicines which dilute and obtund, or such as naturally oppose the particular species of offending acrimony.

It was said before, in §. 386, that a mild or smooth disposition of the humours was necessary, in order to

procure a reſolution of an inflammation; and therefore it is not barely ſufficient to render the obſtructing matter fluid, unleſs the mildneſs is alſo preſerved, or that particular ſpecies of acrimony which attends is corrected. Water, and all watery liquors, are more eſpecially uſeful for this purpoſe: for nothing is milder than pure water, by which the moſt violent acrimony of any kind may be ſo diluted as to be no longer offenſive. Even the moſt concentrated oil of vitriol, which in a moment deſtroys the part to which it is applied after the manner of actual fire, may be ſo weakened by a large quantity of water, as to be ſafely taken into the ſtomach. Now, whenever there is an acrimony in the blood, the thirſt which it occaſions directs the patient to drink a large quantity of water, or ſome other thin liquor, until it is evacuated or waſhed out of the blood either by urine or ſweat. The truth of this is experienced, even in the moſt healthy people, when they have eaten too much ſalted fleſh or the like at dinner. Beſides this, the drinking of thin watery liquors alſo ſatisfies the reſt of the curative indications, of which we treated under the preceding aphoriſm. The diet moſt conducive to the ſame purpoſe, is to be compoſed of emollient pot-herbs, and ſoft pulſe, ſuch as barley, oats, wheat, rice, *&c.* with milk. Hippocrates nouriſhed his patients in theſe acute diſeaſes with nothing but a drink of barley, as is evident from his book, *De victu in morbis acutis.* The beſt remedies in this caſe are thoſe compoſed of emollients, and things which are gently viſcid or mucilaginous, ſuch as marſh-mallows, common mallows, mullen, and the like, in decoctions; with emulſions of oily and farinaceous ſeeds, the expreſſed oils themſelves of thoſe ſeeds, and every thing which ſo obtunds and ſheaths acrimony as to prevent it from doing any injury. But as theſe oils very ſoon become rancid, eſpecially in hot weather, or by the heat of the ſtomach, therefore emulſions are preferable, in which there is the ſame obtunding virtue of the oil, but without any danger of its degenerating into a rancid acrimony. But if there was an acrid cacochymia before the inflammation

tion arose, or if the like acrimony is observed in the juices after the inflammation is produced, then it will be convenient to use those things which are known to be specifically opposite to the apparent acrimony: Thus absorbents are to be used in the acid species of acrimony, and also in the alcaline; but, in a putrid species of acrimony, acids are proper, *&c.*

§. 400. A REPULSION of the matter is procured;

1. By a large evacuation of the arterial and venous blood by phlebotomy.
2. By relaxing the fibres.
3. By artificial frictions.

It was said in §. 395, where we enumerated the general curative indications to be observed for the cure of an inflammation by dispersion or a resolution, that if the obstructed matter could not be rendered so fluid as to pass through the narrow extremities of the arteries, there then remained but one method of cure; namely, by repelling the matter from the smaller extremities into the larger vessels, where they might be taken up with the common circulation, and rendered pervious through those vessels which they ought naturally to pass. This method may take place in every kind of inflammation, but more especially in that kind which arises from the larger particles of the blood mistaking their course; that is, when the orifices of the smaller vessels are so dilated as to take in larger particles than can pass through their small extremities. For instance, if, in such a case, a red globule is repelled back out of the serous artery into which it entered, it will return into the sanguiferous artery, thro' whose ultimate extremity it may easily pass into the vein, by which the inflammation will be resolved or terminated. But in order to repel the matter in this manner, it is necessary either to remove, or very much diminish, the impulse of the vital humours urging upon the back of the obstruction; and at the same time the obstructed vessels are to be so relaxed, that they

may eaſily permit the impacted matter to return back; and, laſtly, a motion is to be communicated to the impervious particles, which may carry them back towards the larger part of the obſtructed veſſel. Each of theſe are accompliſhed by the means propoſed in the three following numbers.

1. Concerning this, you may conſult what has been ſaid in the commentary on § 141, n° 1.

2. For the obſtructing matter being wedged into a narrower part of the veſſel, if the fibres of that veſſel are rigid, the matter will be held ſo faſt as to be immoveable: It will be therefore proper, in ſuch a caſe, to relax the fibres, when the impetus of the fluids urging behind has been firſt diminiſhed: otherwiſe the obſtructed particles will be thruſt further into the relaxed veſſels, which is repugnant to the indication of repelling; for here we are not to attempt a propulſion of the matter through the relaxed veſſels. But in what manner, and by what remedies, the fibres of the human body may be relaxed, has been declared in §. 35, 36, 54.

3. See what has been ſaid concerning the uſe of frictions for this intention, in the commentary on §. 141, n° 2.

§. 401. FROM hence we may be able to underſtand what that deſirable reſolution is, by which a complete cure is performed, without any criſis (386), in all inflammatory diſeaſes, whether external or internal.

In whatever part of the body the inflammation is ſeated, it always retains the ſame definite or preciſe nature; namely, an obſtruction of the arterial veſſels, with a violent impulſe of the vital humours urging on the back of the obſtruction. In what, therefore, conſiſts the reſolution of an inflammation? In ſo attenuating and dividing the obſtructing particles which heſitate in ſome arteries, or by ſo relaxing the obſtructed veſſels, as to give the humours a free paſſage through them, which were before impervious; or even ſometimes by repelling thoſe particles back into the larger veſſels. And it is evident enough, that this method of curing

curing an inflammation is of all the beſt and ſafeſt; becauſe it reſtores the parts to their healthy functions, without offering any further damage to them. But it is not always in the power of a phyſician to cure an inflammation thus by reſolution; the means required for performing which, have been mentioned in §. 386.

Which makes a complete cure.] A reſolution only can be properly called a complete cure of an inflammation, which it removes without inducing any other diſorder: whereas the other ways of terminating an inflammation cannot be ſaid to make a complete cure, ſince they introduce an abſceſs or a ſcirrhus, even tho' they remove the inflammation; for, in this caſe, there is another diſorder introduced, which will require its particular cure before the parts can be reſtored to their healthy ſtate. But when an inflammation terminates in a gangrene or a ſphacelus, it does not then conduce to a cure, but occaſions the death of the parts.

Without a criſis.] What is properly meant by a *criſis* in diſeaſes, and in what manner this word is uſed in various ſenſes among the ancient and modern phyſicians, we ſhall have a better opportunity of explaining hereafter, when we come to treat more profeſſedly on that ſubject in the hiſtory of Fevers. It will be ſufficient for us here to obſerve, that an inflammation is ſaid to be cured *without a criſis*, when the morbific matter (namely, the impervious humours heſitating in the arteries) is ſo diſpoſed by the remaining vis vitæ, and the applied remedies, that it is again rendered capable of paſſing through its veſſels agreeable to the laws of health: But when the ſame matter is removed from the narrow extremities of the obſtructed veſſels, and yet has not thoſe conditions which are required for it to flow through the veſſels with the healthy humours without injuring the functions, it is then either evacuated from the body, or elſe depoſited upon ſome particular part; and then the inflammation is ſaid to be cured *by criſis*, and the evacuation and depoſition of the matter is termed *critical*. For example, when a red globule has entered a ſerous artery by an error of place, and an inflammation thence follows; if that

red

red globule be either repelled back from the ſerous into the ſanguiferous artery, or elſe diſſolved into the ſix ſerous globules of which it is compoſed, according to Leeuwenhoeck, that inflammation will be cured without a criſis, becauſe the morbific matter is ſo diſpoſed as to paſs freely through all the veſſels which it ought to pervade in a ſtate of health. But if the extremity of the obſtructed veſſel is gradually thruſt off, together with its impervious matter, by a moderate impulſe of mild humours urging behind, the obſtruction will be thus removed: But then, from the diſſolution of the continuity of the veſſel, the humours will be extravaſated; and the ſeparated end of the obſtructed veſſel, with its impervious matter, being no longer obedient to the laws of circulation, is therefore to be conſidered as a foreign body which requires to be diſcharged: ſo that the tender ſolids which are thus ſeparated, mixing with the extravaſated humours, are by the heat of the body changed into matter, formed by a mild incipient putrefaction; which matter will therefore require to be evacuated, as it can never be reduced to the ſtate of our healthy juices. And in this manner alſo an inflammation is cured, but by means of a criſis; becauſe the morbific matter is firſt changed by the remaining vis vitæ, and then ſeparated and diſcharged from the body. From hence may be plainly perceived the difference between the cure of an inflammation which is made by a *reſolution*, and that which is made by a *criſis*: and this doctrine will alſo appear agreeable to the general axiom which Galen delivers concerning the various events of diſeaſes, That great diſeaſes are always attended with a criſis, but thoſe which are ſlight are only reſolved[a]. For a ſlight inflammation may be diſperſed, when a violent one terminates either in a ſuppuration or a gangrene.

Of ABSCESSES.

§. 402. IF theſe means (395 to 401) are uſed too late, not at all, or without ſucceſs, the in-

[a] De Criſibus, lib. iii. cap. 4. Charter. Tom. VIII. p. 433.

inflammation then goes on to suppuration (387), which may be known by the signs there (387) mentioned; and the indications will be,

1. To hasten the maturation of the crude matters into one smooth humour.
2. To mollify the same and the parts adjacent.
3. To draw the matter outwards.
4. To procure a discharge to the concocted matter.
5. To mundify or clean the parts.
6. To complete the cure, as in other wounds.

An *abscess*, termed also *apostasis* and *apostema*, was used in various senses by the ancient physicians. For Hippocrates uses this term to denote the change of one disease into another, when he says, *Some fevers and diseases become quartans by abscess* [a]. He also used the term *abscess* to signify that endeavour of nature by which she separated any offensive matter from the blood, either evacuating it from the body, or depositing it upon some particular part: and hence the ancient physicians distinguished two kinds of abscesses; namely, those by *efflux*, and such as were made by *deposition* upon some part [b]. Thus, for instance, in a peripneumony, the morbific matter was observed by them to discharge itself by spitting, a bilious diarrhœa, or a copious and thick sediment in the urine; in which cases the abscess was said to be *by efflux:* But when no such excretion was observed, and there were nevertheless apparent signs that the patient would survive, then Hippocrates [c] observes, that an abscess is to be expected either about the ears, or towards the lower parts of the body, *by a deposition* of the morbific matter in some place. And in this sense abscesses are defined by Galen, *To be those disorders in which parts of the body before cohering recede from each other. There must be therefore of necessity a void space made betwixt the parts; which space will*

[a] Ex aliis febribus et morbis abscessus in quartanas fiebant. *Epidem.* 1. *textu* 21. *Charter. Tom. IX. p.* 44.

[b] Galen. Comment. 2. in lib. i. Epidem. Hipp. text. 44. Charter. Tom. IX. p. 55.

[c] Prognostic. Charter. Tom. VIII. p. 655. et in Coac. nº 395.

will contain either a moisture, or flatus, or a composition of them both. But many tumours of the phlegmonodes and erysipelatous kind, and some inflammations are changed into an abscess, [d] &c. For when the obstructed ends of the inflamed vessels are separated by the impulse of the humours acting behind, they mix with the extravasated juices, and by the warmth of the parts changed into matter, which by removing the contiguous parts makes itself a passage: but as a true phlegmon is almost constantly seated in the panniculus adiposus only, that membrane, by its easy yielding, may be sometimes distended to a very great degree by the matter which it contains. But that such a preternatural cavity is formed by the confined matter after the phlegmon is suppurated, and that it did not before exist, is evident, inasmuch, as by incising the inflamed part with a lancet before any matter is formed, the whole tumour appears solid, and discharges only blood or a thin ichor: but when such a part is wounded after a suppuration is formed, and the matter discharged, there appears a manifest cavity, made by the receding of the parts which were before contiguous.

There is no room to doubt, that the method of curing an inflammation by resolution is of all the best: but as this is frequently not in the power of the physician or surgeon, then a suppuration only remains; since it is evident enough, that the other methods of terminating an inflammation, namely in a gangrene or schirrhus, are much worse. If therefore it shall appear from the signs mentioned in §. 387, that the inflammation is of such a nature, that a resolution cannot be expected; or if there were some hopes at the beginning, but by a neglect, or a perverse treatment continued for many days, the obstructions are confirmed in such a manner that the matter is quite irresolvable; then the curative indications direct speedily to promote a suppuration, in

[d] Affectiones illas, in quibus ab invicem secedunt, quæ prius se mutuo tangebant, corpora. Spatium igitur in medio vacuum fieri necesse est, quod materiam aliquam flatulentam aut humidam, aut ex utraque mistam, continebit. Mutantur autem in abscessum et inflammationes quædam, et Erysipelatosi Phlegmonodesque tumores non pauci, &c. *Method. Med. ad Glaucon. lib.* ii. *cap.* 9. *Charter. Tom. X. p.* 382.

n order to remove all thoſe parts of the ſolids and fluids vhich have been ſo changed as to be no longer obedient o the laws of circulation; and when this is performed, he loſt ſubſtance may be regenerated, and the parts nited which were ſeparated from their natural cohe-ion. But this is what we are to conſider in the ollowing numbers.

1. So long as the material cauſe of a diſeaſe conti-ues of ſuch a nature, as either to continue or increaſe he diſtemper, it is termed *crude:* but when it has been o altered by the remaining vis vitæ, its own natural liſpoſition, or the uſe of proper remedies, ſo as to be eſs remote from the laws of health, and to produce eſs diſturbance in the functions of the body, it is then aid to be *concocted;* and that ſtate of the diſeaſe, in which its material cauſe is thus altered, ſo as to be eſs offenſive, is called the time of naturation or con-coction. This crudity may therefore take place both n the ſolid and fluid parts, and ſo may likewiſe its al-eration or maturation; but, in a plegmon, all the ob-ſtructing matter is called crude, which cannot be re-ſolved, and alſo every veſſel which is ſo obſtructed that it cannot be opened. In order to reſtore health, there-fore, ſuch obſtructed veſſels, with their impervious contained matter, ought to be ſeparated from the reſt of the living and pervious veſſels, and by mixing after-wards with the extravaſated humours be formed into laudable matter. So long therefore as the ends of the impervious veſſels remain unſeparated, the vis vitæ urging on the back of the obſtructions, will increaſe all the inflammatory ſymptoms, (ſee §. 381, 382.); but when this ſeparation is once made, as the humours will then have a free paſſage through the broken ends of the veſſels, it is ſufficiently evident that all thoſe ſymptoms muſt be very much diminiſhed. *Crudity* is therefore known by the intenſity or increaſe of all the ſymptoms; but *maturation* is diſcovered by the remiſ-ſion of them. This is very well expreſſed by Celſus, where he treats of abſceſſes: *But the matter is crude when the arteries have a greater motion, accompanied with a heavineſs, burning, diſtenſion, pain, redneſs, and hardneſs*

hardneſs of the parts; and, if the abſceſs is large, a ſhivering and ſlight fever continue: but when the ſuppuration is near finiſhed, inſtead of theſe there ariſe pricking pains; and when thoſe pains grow more remiſs, and the part itches and looks bluiſh or whitiſh, the ſuppuration is mature [e].

2. The hardneſs or reſiſtance of inflamed parts ariſes from the great compactneſs of the ſolids and fluids (ſee §. 382, no 4.); and ſo long as they continue, the diſorder may be juſtly termed crude. But maturation requires a ſeparation of the ends of the obſtructed veſſels from the other ſound parts; and therefore, the more thoſe veſſels are mollified and in a manner diſſolved, the ſooner and with leſs pain will they be ſeparated. But if a violent phlegmon has invaded a part, we generally obſerve that all the circumference of the tumour remains hard, even though the middle of the part affected turns ſoft; and therefore the adjacent parts of the tumour are to be fomented with emollients, as Celſus obſerves, when he ſays, *If there are any adjacent parts harder than the reſt, they are to be mollified by the application of bruiſed mallows, or the ſeed of fenugreek, or linſeed boiled in ſack* [f].

3. If matter ſhould be formed by ſuppuration in an inflamed part ſeated in the external ſurface of the body under the ſkin, the ſkin is then uſually elevated into a tumour, and this more eſpecially if the part is fomented with emollient and relaxing medicines. But if the inflammation is more deeply ſeated, there will be more danger, leſt the matter ſhould make itſelf ſinuſes in the adipoſe membrane; or, if it is ſeated in ſome of the internal parts, it may corrupt the viſcera with a putrid tabes. So ſoon therefore as it appears from the ſigns mentioned in §. 387, that the inflammation tends to ſup-

[e] Crudum eſt autem, in quo major quaſi venarum motus eſt, et gravitas, et ardor, et diſtentio, et dolor, et rubor, et durities; et, ſi major abſceſſus eſt, horror, atque etiam febricula permanet: penituſque condita ſuppuratione, pro his, punctiones ſunt. Ubi iſta ſe remiſerunt, jamque is locus pruit, et aut ſublividus, aut ſubalbidus eſt, matura ſuppuratio eſt. *Lib.* v. *cap.* 28. no 11. *p.* 327.

[f] Si qua circa duriora ſunt, ad ea mollienda, vel malva contrita, vel fœni græci linive ſemen ex paſſo coctum ſuperandum eſt. *Ibid. p.* 328.

ſuppuration, then all the endeavours of art are to be uſed to draw the matter to ſome external part. Celſus, in treating of the cure of a pleuriſy, recommends bleeding for a ſevere pain which is recent, but when that remedy is uſed too late, or proves fruitleſs, he ſays, that then *recourſe is to be had to cupping-glaſſes before the ſkin is inciſed. It is alſo right to apply muſtard and vinegar upon the breaſt, till it has excited bliſters or ſores; and then to uſe a medicine which may ſtir up the humour, and direct it thither* [g], &c. In a peripneumony, when the diſorder is increaſed to the higheſt, he obſerves, *That it may be alſo ſerviceable to apply ſalt finely ground and mixed with cerate to the breaſt; becauſe it gently corrodes the ſkin, and by that means calls off the violence of the matter which injures the lungs. It is alſo uſeful to apply a cataplaſm of ſuch things as draw matter* [h]. If now the matter formed can be conveniently drawn outwards, the event of the inflammation need not be ſo much feared: for patients often die after a ſuppuration from a pleuriſy, while the ulcer full of matter does by its tumor preſſing inward obſtruct the lungs, and produce ſuffocation; or elſe, by breaking, depoſits its matter into the cavity of the thorax, whence an empyema, conſumption, and death. But if an abſceſs formed about the ribs ſhould point outwards, and cauſe a tumour in the external ſkin, a happy cure generally ſucceeds by opening the tumour and diſcharging the matter. For theſe reaſons, the ancient phyſicians applied irritating ſubſtances to ſtimulate the external parts; or elſe they fomented the parts with emollient cataplaſms and fomentations, to derive the impetus of the diſeaſe outwards.

4. When the ends of the obſtructed veſſels, together with their impervious blood, mix with the adjacent hu-

[g] Confugiendum eſt ad cucurbitulas, ante ſumma cute inciſa. Recte etiam ſinapi ex aceto ſuper pectus imponitur, donec ulcera puſtulaſque excitet; et tum medicamentum, quod humorem illuc citet, &c. *Lib.* iv. *cap.* 6. *p.* 209, 210.

[h] Prodeſt impoſitus ſuper pectus ſal bene contritus, cum cerato miſtum; quia leviter cutem erodit, eoque impetum materiæ, quo pulmo exatur, evocat. Utile etiam aliquod malagma eſt ex his, quæ materiam trahunt. *Ibid. cap.* 7. *p.* 212.

mours, and by the warmth and ſtagnation in a cloſe place form a white fat and uniform liquor, it is then ſaid to be concocted matter; but by what ſigns one may know that ſuch a matter is preſent, we ſhall explain hereafter at §. 405. But when this matter is contained long in a cloſe and warm place, it becomes gradually thinner and more acrimonious: and as there are ſmall abſorbing veins which open throughout the whole ſurface of the cavity in which the matter is confined, it will be drank up by thoſe veins, and conveyed into the maſs of blood; whence it will occaſion a purulent cacochymy, whence a hectic fever and conſumption follow. Beſides this, the matter, rendered more acrimonious, will corrode the whole ſurface of the part in which it is contained; and, being at the ſame time attenuated, it may very eaſily make itſelf new paſſages in the panniculus adipoſus; from whence ſinuſes and fiſtulæ of the worſt kind often follow, barely for want of procuring a timely diſcharge to the concocted matter. And from hence again the difference betwixt curing an inflammation by *reſolution* and *ſuppuration* is ſufficiently apparent. For when the inflammation is *reſolved*, the matter of the diſeaſe is ſo ſcattered by the remaining vis vitæ, and proper remedies, that it becomes very much like the healthy humours with which it flows through all the veſſels without injury to any of the functions; and therefore no evacuation is required. But when, by *ſuppuration*, a ſeparation is made of thoſe ſolids and fluids which the inflammation has deſtroyed, they then turn into laudable matter: which yet is a liquor quite foreign to the nature of our humours, and by mixing with them diſturbs all the functions, and excites a fever, until it is either evacuated from the body, or elſe ſeparated from the blood, and tranſlated to or depoſited in ſome particular part of the body; from whence again it muſt be evacuated, in order to perform a cure. It is therefore evident, that an evacuation of the concocted matter is neceſſary; and that in due time, ſince it always becomes acrimonious by long ſtanding. For what ill conſequences may follow when matter is too long confined

fined in an abſceſs, we are taught by practical obſervations. A maid of forty years old had a ſuppuration of the left parotid, ſo that on the fourteenth day of the diſeaſe there was an abſceſs as large as one's fiſt. And though no fever attended in the beginning of the diſorder, but ſhe every day followed her domeſtic buſineſs; yet as the confined matter was not timely diſcharged, it produced a fever, attended with the worſt ſymptoms, ſuch as faintings, vomitings, watchings, *&c.* of which ſhe expired a few days after. The abſceſs was indeed broken ſeveral days before death, but little or no matter was diſcharged [i]. In a child of three months old there aroſe an abſceſs about the right ſhoulder: but as the parents would not allow it to be opened, the tumour naturally ſubſided of itſelf; but the abſorbed matter being tranſlated to the genital parts, it there produced a fatal gangrene [k]. There are many obſervations of the like nature, which demonſtrate how dangerous it is to leave concocted matter confined for too long a time in a vomica or abſceſs.

5. So long as the part ſuppurated remains cloſe, it is termed *vomica clauſa* or an *abſceſs*; but when a diſcharge of the matter has been procured either by art or nature, the diſorder is then termed a *vomica aperta* or an *ulcer*. But the whole internal ſurface of the cavity, in which the matter is contained, is more or leſs infected by the matter, eſpecially when that has been confined a long time, and rendered more acrimonious by heat. It is not therefore poſſible either to procure a conſolidation or union of the parts, nor a reſtitution of the loſt ſubſtance, before the whole ſurface of the cavity is firſt reduced to the ſtate of a clean wound. Therefore the half-dead extremities of the veſſels, and half-corrupted parts of the panniculus adipoſus, muſt be firſt ſeparated, and all the reſt performed in the manner we directed in the Hiſtory of Wounds, §. 206, 207, 208. Hence Hippocrates tells us, *That foul ulcers will not unite, even though they are retained together; nor will they conjoin of their own accord. Ulcers likewiſe, whoſe circumjacent parts are inflamed, cannot unite*

i Hildani Obſerv. Chirurg. cent. 1. obſ. 39. p. 33. k Ibid. obſ. 81. p. 59.

as long as the inflammation continues. Nor can ſuch ulcers be healed or conjoined, if the circumjacent parts are black, beſet with putrid blood, or accompanied with a varix which bleeds; all which will prevent the union, unleſs you reduce the circumjacent parts of the ulcer to their healthy ſtate[1].

6. After the ulcer has been depurated, it acquires the nature of a clean wound; and then a regeneration of the loſt ſubſtance, and an union of the parts ſeparated, may be procured.

§. 403. THE maturation is performed by applying ſuch things as,

1. Increaſe the motion of the humours in the part, by fomenting, ſtimulating, and warming materials, which either warm actually or virtually; and the uſe of the like remedies in the whole body may be ſerviceable by exciting a fever.

The maturation of all crude inflammatory matter into concocted pus muſt be performed by the remaining vis vitæ; for when the ſtrength of life is defective or languid, no matter is formed: and therefore Hippocrates [a] reckons the appearance of dryneſs in an ulcer, either before or in a diſeaſe, among the ſigns of death. It is alſo from a weakneſs of the vital powers, that the ſpitting is diminiſhed, or even frequently quite ceaſes, in the latter end of a pulmonary conſumption. But the vis vitæ is eſtimated or meaſured by the force of the circulating humours through the veſſels: and as the obſtructed ends of the veſſels with their impervious contained matter are to be ſeparated by the impulſe of the humours acting behind, it is evident that this ſeparation will be ſooner performed if the ſtrength and

[1] Ulcera non purgata coire nolunt, etiamſi adducantur; neque etiam ſponte coaleſcunt. Ulcera etiam, quorum circumpoſitæ partes inflammantur, coire non poſſunt, quamdiu non ceſſaverit inflammatio. Neque, ſi ambientes ulcus partes denigratæ fuerint, aut ſanguis putreſcens, aut varix ſanguinis influxum ſuppeditans adfuerit, talia coire poſſunt, niſi circumſtantes ulceris partes ſanas effeceris. *De Ulcer. cap. 4. Charter. Tom. XII. p. 132.*

[a] In Prognoſticis, Sent. 22. Charter. Tom. VIII. p. 605.

and ſwiftneſs of the blood's motion is increaſed thro' the veſſels of the part to be ſuppurated; for then the circulating fluid will ſtrike more frequently and ſtrongly in a given time againſt the obſtructed ends of the veſſels, and ſeparate them ſooner from their coheſion. Hence it is that we enumerated an increaſed motion of the humours among thoſe conditions (§. 387) which cauſe an inflammation to tend to ſuppuration. But it is to be obſerved, that too great a velocity of the humours ſuddenly excites a rupture in the veſſels, and does not procure a gradual ſeparation of their ends; whence a gangrene follows inſtead of a mild ſuppuration, as was obſerved before at §. 388. A juſt medium is therefore here required, ſo as to keep up the motion of the humours greater than in health, but not to let them move too violently. But the heat of the inflamed part when it is ſeated in the ſurface of the body, or a more or leſs fever when it is ſeated internally, will demonſtrate whether the motion of the humours ought to be increaſed or diminiſhed. Therefore the motion of the humours, if defective, is to be excited by the application of topical remedies to the affected part, and by the uſe of internal medicines. And as we obſerved, in the comment to §. 371, that an inflammation is accompanied with a fever either in the whole or in the particular part of the body; ſo it will be alſo neceſſary to increaſe the motion of the blood, either in the inflamed part only, when that can be done; or elſe throughout the whole body, by exciting a ſlight fever. Thus we ſee, in conſumptive patients, that a ſlight fever always invades the patient every day while the matter is forming, but diminiſhes when the formed matter is ſpit up. Therefore Hippocrates has pronounced, in the place we before cited in the comment on §. 387, That the pains and fever are more intenſe about the time when matter is forming, than after it is completely formed. In the Materia Medica correſponding to this ſection, the aromatic gums are recommended to us, ſuch as ammoniacum, galbanum, opopanax, *&c.* in all which there is a moderate ſtimulus, and at the ſame time a ſufficient de-

gree of tenacity by which they adhere to the part where they are applied; and thus, by confining the very subtile exhaling vapours, they keep the part as it were in a vaporous bath of its own, and at the same time their aromatic stimulus insinuates into the relaxed vessels: and hence it is that the application of these remedies has often such happy effects, when a scirrhus is feared from too weak a motion of the humours. Besides, all these things which excite a greater motion in the affected part by such a mild stimulus, have also the virtue of warming or heating; because a greater heat arises from an increased motion of the humours through their vessels, as was demonstrated in the commentary on §. 382, no 6. Those things which are actually warm, are also very serviceable; provided they are not applied so hot as to dissipate the more fluid parts of the humours, and convert the remaining parts into the hardness of a scirrhus. Therefore the best way of all, in this case, will be to apply warmth with moisture; *viz.* by the use of cataplasms and fomentations, secured with hot woollen cloths or the like, to retain the parts in a gentle and constant heat. For, as Hippocrates says, *a suppurating heat is not a sign of the greatest success in every ulcer; though it mollifies and extenuates the skin, abates the pain* [b], &c. But why Hippocrates says, *not in every wound or ulcer*, is explained by Galen, in his commentaries to this aphorism; namely, because hot things are hurtful to putrid and running ulcers, by increasing their putrefaction, and attracting their flux of humours.

2. The heat and motion excited in the part are there confined, by preventing too great an exhalation and dissipation of it, by constipating or glutinous substances, and by diminishing the too great acrimony.

The inflamed part is always hotter than is usual in health,

[b] Calidum suppuratorium, non in omni ulcere, maximam securitatis signum: cutem emollit, extenuat, dolorem sedat, &c. *Hippoc. Aph.* 22. *sect.* v. *Charter. Tom. IX. p.* 207.

health, (see §. 382, n° 6.); and as all the symptoms of the inflammation increase when it tends to suppuration (see §. 378,) therefore the heat will be increased while that is forming. But by an increase of heat the more fluid parts of our humours are dissipated, as will be evident from the commentaries on §. 689; therefore it will be extremely serviceable to apply such things as continually moisten as well as warm the affected part, in order to restore those thin vapours which are continually dissipated by the increased heat. Those remedies will be therefore best which contain a large quantity of water, and which do not easily suffer it to exhale again; and such are all glutinous substances which with water are capable of forming a soft paste, such as all meals, and especially that of linseed, which is capable of imbibing a large quantity of water. Of these and such like substances may be formed very emollient cataplasms; of which there are various forms given in the Materia Medica corresponding to this aphorism. If these are involved on all sides about the part to be suppurated, and suffered to continue there day and night, especially if care be taken to keep them warm; they will very quickly cause any irresolvable inflammation to suppurate and be converted into laudable matter. But as all these remedies mollify as well as moisten and relax the solid parts, they consequently very much diminish the pain attending a suppuration, (see §. 228, n° 1.) They likewise mitigate all acrimony, by sheathing and obtunding; and so are serviceable in this respect, inasmuch as they conduce to that mild disposition of the humours which is required towards a suppuration, as was said in the commentary on §. 387. But as there is here no small danger of a putrefaction in the humours which stagnate in the obstructed vessels (see §. 84. n° 4, and 5.) promoted by the increased heat and quicker motion of the humours through those adjacent vessels which remain pervious; therefore such substances are to be chosen as are soon altered, by the heat of the part to which they are applied, into a disposition opposite to that of putrefaction; that is to say, which easily turn sour. Hence it is that surgeons add rye-flour, vinegar, sorrel,

rel, and the like ſubſtances, which ſoon turn acid, in the compoſition of their maturating cataplaſms: and to theſe they uſually add alſo freſh butter, linſeed-oil, or the like very ſoft and fat ſubſtances, partly becauſe they prevent too great a diſſipation of the moiſture from the cutaneous pores, and partly becauſe by this means the cataplaſm is prevented from drying and growing hard too ſoon.

3. By moderating the motion of all the vital humours, and their temperature; ſo that they may neither be ſluggiſh, nor too violently excited.

This rule is of the greateſt moment in the practice of phyſic, as well in the cure of internal as of external diſeaſes. An increaſed motion of the humours cauſes an inflammation to tend to ſuppuration, (ſee §. 387;) but too violent a motion of them cauſes a ſudden deſtruction of the very tender and minute veſſels, and produces a gangrene, (ſee §. 388.) But, in the reſolution of an inflammation, the motion of the humours is but moderate, (ſee §. 386.) So long therefore as there is hopes of a reſolution, the phyſician or ſurgeon boldly diminiſhes the impetus of the vital humours, by the remedies mentioned at §. 396, in order to prevent any further hurt to the inflamed veſſels: but when the ſigns denote that it is impoſſible to *reſolve* the inflammation, then it is required to give the humours a greater motion than they had naturally in a ſtate of health, in order to ſeparate the obſtructed ends of the veſſels, and convert them with the extravaſated humours into laudable matter; from whence it is evident, that in ſuch a caſe it may be often prejudicial to uſe thoſe things which weaken the force of the circulation. It is therefore here neceſſary ſo to moderate the courſe of the humours through the veſſels, as to make them paſs with a greater heat and motion than is uſual in health, either by the exhibition of medicines internally, or by the application of topical remedies to the affected part where the ſuppuration is to be made; but yet theſe remedies ought not to be ſo violent as to deſtroy all the vital influx of the humours by ſuddenly burſting the veſſels,

els, that is, ſo as to produce a gangrene. That the humours flow thus moderately, may be known, if the heat of the inflamed part does not much exceed the heat of the blood in health; if a pain attends, but not violent; if a moderate pulſation is perceived, together with a tumour, redneſs, and the other ſymptoms of inflammation gradually increaſing: and by the appearance of theſe ſigns in the affected part, we are informed whether the vital motion of the humours ought to be increaſed or diminiſhed. But when the inflammation is ſo great as to diſturb the whole body, then the intenſity of the fever, thirſt, and dryneſs of the tongue, eaſily demonſtrate what ought to be done to moderate their violence. There is therefore no univerſal ſuppurating medicine; but different remedies are required, according as the motion of the humours is to be either increaſed or diminiſhed. To promote a ſuppuration in the body of a young perſon of a warm habit, it will be proper to apply a cataplaſm of oatmeal, milk, and freſh butter: but, in old people, of a melancholic or cold habit, it will be proper to add roaſted onions, galbanum, gum ammoniac, and the like moderate ſtimulators, that, by gently increaſing the motion of the humours, a ſuppuration may the better ſucceed in the inflamed part, and prevent a ſcirrhus; which laſt is too often the conſequence of an inflammation that is too languid in ſome glandular part. The ſame doctrine is alſo true in regard to internal inflammations. Thus, in the beginning of a pleuriſy, a very bold uſe of the lancet, continued till the patient faints, often removes the diſeaſe: but when the phyſician, being called too late, perceives that it is no longer poſſible to procure a reſolution, it then remains to concoct or digeſt the morbific matter, and diſcharge it by ſpitting, urine, or ſome other evacuation; or elſe, finally, to convert it into an abſceſs. And at that time bleeding, and other evacuations which too much weaken the vital powers, are always prejudicial; ſince, in ſuch a caſe, a moderate fever is required to maturate the crude matter of the inflammation.

4. The

4. The inflamed parts is not to be opened till all the inflammatory matter is ſuppurated. For by theſe means laudable matter is made in the part.

It frequently happens in the larger abſceſſes, that the center of the ſuppurating part appears ſoft and yielding to the fingers, while in the mean time the greater part of the inflamed tumour continues hard in all its circumference. But as many bad conſequences may follow by confining the matter too long in a cloſe place after it has been formed, as we ſhall explain more at large in the commentary on §. 406, therefore ſurgeons uſually make haſte to open ſuch tumours, even when they perceive but a ſmall fluctuation. But all the diſorders which have been obſerved to follow too long a confinement of the matter, proceed either from the acrimony or putrefaction which it by that means acquires; and as the quantity of it gradually increaſes, it eats new paſſages into the panniculus adipoſus, and produces ſinuoſities and fiſtulous ulcers: or elſe a purulent cacochymy is produced in the blood, from an attenuation and abſorption of the matter taken up by the bibulous veins: or, laſtly, the more fluid parts of the matter being diſſipated, the reſt thickens, and produces ſcirrhous tumours, eſpecially in the glandular parts. But ſo long as the part remains not opened, and no acceſs is given to the air, the matter does not ſo ſoon degenerate into a putrid ſtate; and, being confined within its cavity by the hard circumference of the tumour on all ſides, it cannot eaſily burrow into the panniculus adipoſus; nor can there be any great danger of the matter's being abſorbed, ſince the arterial veſſels, which are diſtended with an irreſolvable inflammatory matter, compreſs the adjacent veins. Beſides this, the matter lodged in an abſceſs, which is but thus half maturated, makes one of the beſt remedies by which all the adjacent or as yet hard and crude matter may be diſſolved or conſumed. Hippocrates has a ſentence of the like nature, which we mentioned in the comment on §. 323. *Contuſed and lacerated fleſh, muſt neceſſa-*

neceſſarily be diſſolved and changed into matter [a]. Thus it was alſo obſerved in the commentary on §. 158, nº 7. that the matter formed in a wound diſſolved the lacerated fibres and extremities of the inflamed veſſels, with their obſtructing matter. It is therefore evident, how uſeful it muſt be not to open the ſuppurating part till all the crude inflammatory matter is brought to maturation: for thus we imitate nature, who moſt happily accompliſhes the ſuppuration of what ought to be changed into matter, while the integuments of the part remain whole. In like manner, after the parts have been divided by a recent wound, and the hæmorrhage is over, a bloody cruſt is then formed upon the ſurface of the wound, which is cleanſed by a mild ſuppuration under that cruſt. And hence Hippocrates, every where obſerving the dictates of nature, lays it down as a medical axiom, That whatever is required to be concocted ought to be ſhut up from the air; but when the intention is contrary, we are to open and dry up the parts [b].

If now every thing which we have enumerated in the four preceding numbers is put in practice, then laudable matter will be formed in the part: But what the conditions of good and laudable matter are, has been ſaid in the commentaries on §. 387.

§. 404. UNLESS the inflammatory matter is thus altered or maturated, it will be both dangerous and unſucceſsful to make an opening of the abſceſs.

For if the tumour is opened before the matter of an inflammation is brought to maturity, mere blood is then diſcharged inſtead of matter, as we ſaid in the commentary on §. 382, nº 2; or, if the matter is but in part ſuppurated, by diſcharging that, the reſt will be indurated, and cannot ſo ſoon and ſo eaſily be brought to maturation. Beſides this, when tumours are laid open by inciſion in their crude ſtate, they always excite more ſevere pain; and there is greater danger of hurting

[a] Neceſſe eſt, carnes contuſas et lacceratas in pus verſas tabeſcere. *De Capitis Vulner. cap.* 14. *Charter. Tom. XII. p.* 121.

[b] Epidem. lib. vi. textu 34. Charter. Tom. IX. p. 416.

ing the ſubjacent parts by perforating the ſkin. For, in a mature abſceſs, the confined matter elevates the ſkin from the ſubjacent parts; and therefore an opening may be more eaſily made by the lancet when its ſharp point enters into a cavity full of matter, whence there will be no danger of injuring the veſſels or muſcular fibres. Hence Celſus, in treating of abſceſſes which are formed in nervous parts, ſays, *But though in other tumours which are in ſome meaſure crude, an opening may be made: yet among the nerves or tendons, the laſt degree of maturity is to be waited for, whereby the ſkin may be extenuated, and come into contact with the matter, as it points more outward* [a]. The ſame will be alſo true in thoſe places where large blood-veſſels are ſeated, as in the groins and armpits, in which there are inflammatory tumours frequently formed, tending afterwards to ſuppuration: For no prudent perſon will open ſuch an abſceſs before the maturation is completed, becauſe the large veſſels, or their conſiderable branches, may be eaſily injured, to the hazard of the patient's life, when they are opened too ſoon. But how much the cure will be retarded, and the pains augmented, if an abſceſs is opened while crude, is evident from the obſervations of the beſt ſurgeons. For a very painful and inflammatory tumour was formed after a fever in the axilla of a certain nobleman: the ſurgeon who attended, deſpiſing more prudent advice, opened the tumour with a lancet as ſoon as he perceived a ſlight fluctuation; which was performed with no ſmall pain to the patient, who was not at all relieved by the ſmall diſcharge of matter, but on the contrary the fever and inflammation were increaſed. The diſorder was afterwards cured by a long continued uſe of emollient cataplaſms; tho' it might have been cured in a few days time, if the tumour had not been injudiciouſly opened before its maturation was compleated. The ſame thing is alſo proved by many more inſtances, alledged by the celebrated le Motte [b], whom we have ſo

[a] Sed cætera etiam ſubcruda aperiri poſſunt; inter nervos ultima exſpectanda maturitas eſt, quæ cutem extenuet, eique pus jungat, quo propius reperiatur. *Lib.* vii. *cap.* 2. *p.* 409.

[b] Traité Complet de Chirurgie, Tom. I. p. 211.

ſo frequently quoted. Thus I have ſometimes ſeen venereal buboes, which, being opened too ſoon for fear of a confirmed lues, have occaſioned the greateſt difficulties, and often proved incurable for ſeveral months, the ſurgeons being obliged to conſume them by cauſtics; when they might have been diſperſed with ſafety and certainty in a few days time, by letting the matter continue longer confined in the parts. But it is to be obſerved, that the outermoſt margin in abſceſſes has often ſome degree of hardneſs, while the reſt is perfectly brought to maturity: now when ſuch tumours break of their own accord, and diſcharge all their matter, thoſe hard remains are uſually melted down and diſcharged in a few days time. It will not be therefore prejudicial to open ſuch tumours as have the greateſt part of them ſuppurated.

§. 405. THAT the matter is formed and fit to be diſcharged, is known by the ſoftneſs of the part, a fluctuation and whiteneſs of the preſſed tumour, a remiſſion of the pain, heat, redneſs, tenſion, pulſation, and fever, inſtead of which a dull or heavy pain ſucceeds, and the tumour forms a prominent point.

Since therefore it is dangerous to open a tumour which tends to ſuppuration, before it is perfectly maturated; and as many bad conſequences may alſo follow, if the formed matter is too long confined and ſhut up, as we ſhall declare under the following aphoriſm; therefore it is neceſſary to give a diligent attention to thoſe ſigns which informs us, that the matter is ſo far advanced and collected in an abſceſs, that it may be ſucceſsfully diſcharged by opening. But theſe ſigns are deduced from the alteration of thoſe appearances which happen in the affected part, from the beginning of the ſuppuration, even until a perfect maturation is completed.

A ſoftneſs of the part.] It was demonſtrated in the commentary on §. 382, n° 4. that a conſiderable hard-

neſs in a phlegmon proceeded from the ſolids and fluids being violently compacted together, becauſe the inſpiſſated blood ſtagnated in the obſtructed veſſels which were as yet entire. But when the diſtended veſſels are burſt open, and their humours extravaſated in the ſuppuration of a phlegmon, the tender ſolids are then torn off, ground together, and diſſolved in the humours, ſo as to form matter, (ſee §. 387); whereupon a ſoftneſs neceſſarily follows, by a converſion of the inflammatory matter, which was before hard and crude, into a yielding fluid under the entire ſkin. For there may be a conſiderable hardneſs in bodies, even though moſtly compoſed of fluids, provided the juices are contained in diſtinct veſſels, and not accumulated together into one part; of which we have an inſtance in apples, pears, turnips, *&c.* For though theſe fruits have an incredible quantity of juice, yet they often appear very hard: but by bruiſing, or by dreſſing with fire, they turn into a ſoft pulp; becauſe then the elaſtic air concealed in thoſe fruits, being rarefied by heat, breaks their veſſels and extravaſates their humours, inſomuch that the hardeſt apple is thus ſoftened to ſuch a degree in a quarter of an hour's time, that it runs or ſpreads about. The ſame thing alſo happens when the continuity of the veſſels in ſuch fruits is diſſolved by putrefaction.

Fluctuation of the preſſed tumour.] That ſurgeons may be aſſured whether or not the inflamed part is uniformly ſuppurated, they uſually apply their fingers to each ſide of the tumour, preſſing it gently firſt to one ſide, and then to the other; and if they perceive a fluctuation or undulating motion of the contained humour upon the ſide oppoſite to that which they preſſed, they then know that the whole compaſs of the tumour is ſufficiently maturated. But when no ſuch fluctuation can be perceived, even though the tumour appears ſoft on all ſides; then there may be ſome crude inflammatory matter in its middle, which hinders the motion impreſſed on one ſide of the humour from being communicated to the oppoſite ſide. And that there are ſuch abſceſſes which are in a manner divided in the middle by

by a crude matter there ſeated, while there is a perfect maturation in their circumference, we are taught by chirurgical obſervation; and even Hippocrates has obſerved the ſame, when he ſays, *Tumours which project outwards, which are high and ſharp-pointed, and which are not hard in their circumference, but uniformly maturated, and tending downwards, without a diviſion in their middle, theſe are of the better kind: but the contrary ſort are bad, and thoſe which are the moſt contrary are the worſt* [a]. Alſo Galen, in his commentaries on this text, obſerves, *That, in tumours which are thus divided, the middle is obſerved to have one fault, namely, a part that is crude and hard* [b]. It is indeed true, that a mature abſceſs has this fluctuation in common with aneuriſms, and ſome veſicular tumours which contain juices; but yet an abſceſs is very well diſtinguiſhed from theſe, inaſmuch as it follows from an inflammation preceding. But it is ſufficiently evident, that this fluctuation cannot be eaſily perceived by preſſing upon the tumour, unleſs it is protuberant; for when an abſceſs is lodged deeply in the panniculus adipoſus among the muſcles, it cannot be eaſily diſcovered by this ſign.

Whiteneſs.] It was demonſtrated in the commentary on §. 382, n° 1, 2. that redneſs accompanies an inflammation, becauſe the obſtructed veſſels, together with the panniculus adipoſus, are diſtended with red blood; and therefore when the impacted inflammatory matter, together with the ends of the obſtructed veſſels, paſs into white and uniform matter, then the cauſes of the increaſed redneſs will be removed. Beſides this, the riſing matter from within, and the application of emollient cataplaſms or ſomentations without, macerate the ſkin; which therefore becomes waſted, and acquires a white colour. For when the exhaling vapours of the ſkin are confined by the application of a plaſter, they moiſten the ſkin ſo much, that in a few

[a] Tubercula foras protuberantia, in acumen ſublata et faſtigiata, et æquabiliter commatureſcentia, neque in ambitu dura, et deorſum tendentia, neque bifida, meliora (ſunt.) Contraria mala; et quæ plurimum contraria, peſſima. *Epidem. lib* vi. *textu* 13. *Charter. Tom. IX. p.* 375.

[b] In bifidis medium non ſine vitio inveniri, crudum (ανεκπυητον) nempe et durum. *Ibid. p.* 376.

days time it appears white; and by degrees the ſubjacent white matter appears through the extenuated ſkin, which conduces to render it of that colour. From hence therefore the reaſon is evident, why a white colour is juſtly enumerated among the ſigns of a mature abſceſs.

Remiſſion of the pain, heat, redneſs, tenſion, pulſation, and fever.] All theſe ſigns of inflammation are produced by the impulſe of the blood received from the remaining vis vitæ, by which it urges againſt the ends of the obſtructed veſſels with an increaſed force and velocity, (ſee §. 381.); and the reaſon of all theſe we gave in the commentaries on §. 382. Therefore, after the ends of the obſtructed arteries have been ſeparated by a ſuppuration, the cauſe of theſe ſymptoms will be removed, or at leaſt be very much diminiſhed; and therefore Hippocrates juſtly obſerves, that the pain and fever are greater about the time of the matter's forming than when it is already formed, (ſee the paſſage cited from him in the commentary on §. 387.) But it muſt be obſerved, that ſometimes the moſt acute pain continues, even though the part to be ſuppurated has acquired a perfect maturation; and this becauſe the confined matter daily increaſing, gradually diſtends the ſuperincumbent ſkin: but this pain immediately ceaſes, when the abſceſs either breaks ſpontaneouſly, or is opened with a lancet. Therefore Celſus, having enumerated the ſigns by which the crudity of an abſceſs is diſcovered, (ſee the commentary on §. 402, n° 1.) immediately ſubjoins, *When theſe ſigns are diminiſhed, and the part begins to itch, or appear bluiſh or whitiſh, the ſuppuration is then mature* [c]. For it muſt be obſerved, that though the ſkin generally appears white when the abſceſs is mature, yet the cutaneous veſſels are ſometimes ſo much compreſſed by the diſtending matter, that by the deſtruction of the vital influx and efflux of the humours through them, the ſkin acquires a livid colour, and becomes gangrenous. Almoſt the ſame ſigns of a maturation of an abſceſs are related by Ægineta; for,

[c] Ubi iſta ſe remiſerunt, jamque is locus prurit, et aut ſublividus aut ſubalbidus eſt, matura ſuppuratio eſt. *Lib.* v. *cap.* 28. n° 11. *p.* 327.

for, after enumerating the ſigns which denote that the inflammation tends to ſuppuration, he ſays, *After the abſceſs is formed, many of theſe ſymptoms are diminiſhed, a pricking or an itching follows, a torpidity is felt, and the tumour is elevated into a ſharp point, ſoft and yielding to the touch, and the ſurface about the point of the tumour is gradually abraded* [d]. Here he well remarks the manner in which the ſkin is gradually eroded by the confined matter extending to the point of the abſceſs.

The tumour forms a prominent point.] When a phlegmon tends to ſuppuration and maturity, there is almoſt conſtantly a ſoftneſs and fluctuation perceived in the middle, even tho' the circumference remains as yet hard: but as it is uſual to apply emollient cataplaſms to promote the ſuppuration, therefore the relaxed integuments uſually give way in their centre to the matter which is gradually formed, by which they are extended above the equable ſurface of the tumour; ſince in the other parts of the tumour, its greater hardneſs prevents its eaſy extenſion. For this reaſon therefore the tumour will be formed with a point outwards; in which place the integuments being gradually weak and diſtended, the abſceſs will there break of its own accord, or may be moſt ſafely opened by the lancet.

A dull or heavy pain.] It was ſaid a little before, that the pain increaſed as long as the inflammation laſted in the ſuppurating parts: for the ends of the obſtructed veſſels are to be gradually broken off; and therefore, when the nervous fibres diſperſed through their coats are the neareſt to breaking, the pain will be the moſt acute, (ſee §. 221.) but will ceaſe when they have been quite broken aſunder. But then there will be matter formed, from the juices extravaſated in ſome preternatural cavity which they make, or elſe collected in ſome natural cavity dilated; and, by the weight of the matter diſtending the parts, there will be a dull or heavy pain, as if cauſed by a weight. For

 though

d Conſummato abſceſſu, plurima (horum) minuntur, puncturæ autem prurigino æ fiunt, et torpor ſentitur, et tumor in apicem acutem elevatur, tangenti lenis et cedens, et ſuperficies circa apicem abraditur (ἀποσύρεται.) *Ibid. cap.* 81. *p.* 64.

though a healthy perſon does not perceive the weight of his own body, yet when the humours are extravaſated and collected, he will immediately perceive a heavineſs or pain of wearineſs. When the blood is collected in the panniculus adipoſus, after a rupture of the veſſels under the entire ſkin from ſome violent contuſion, the patient immediately complains of an unuſual heavineſs or uneaſineſs in the part, (ſee §. 329, n° 2. When the ſerum accumulated in the dropſy called *anaſarca* diſtends the legs, the patient draws them after him as if they were made of lead. But it is very evident, that this ſenſe of heavineſs can take place only when the ſuppuration is large; it being one of the principal ſigns of a latent abſceſs from an internal diſeaſe, if, after an acute pain, the patient perceives the ſenſe of an internal weight preſſing upon the affected ſide, as will hereafter be made evident in the Pleuriſy, Perpipneumony, and the like diſeaſes, when we come to treat of them particularly.

§. 406. IF now the matter be left a long time confined in the part, it becomes attenuated, putrefied, augmented, and erodes or conſumes the adjacent parts; by which, with its quantity, weight, and motion, it creates ſinuſes and fiſtulæ of different kinds, in different parts of the body, but the worſt in or near the inteſtinum rectum: Or the more thin juices of the matter being diſſipated, the reſt is indurated, and forms hard tumours, more eſpecially ſeated in glandular parts: Or, laſtly, the matter being abſorbed by the lymphatic veins, or elſe preſſed into the mouths of the eroded blood-veſſels, it then mixes with the blood, which it infects, and, being collected in the viſcera, conſumes them with abſceſſes of the worſt kind, diſturbs their functions, and by that means produces an infinite number of diſeaſes of the very worſt kind.

After

After it has appeared, from the ſigns mentioned under the preceding aphoriſm, that all the crude inflammatory matter is brought to maturity, and changed into a laudable matter, then that matter ought to be diſcharged as ſoon as poſſible: for when once the matter is arrived to its laſt perfection, being white, thick, ſmooth, uniform, and inodorous; from that time it begins gradually to degenerate, and is every day altered for the worſe. For the matter is not contained in the veſſels, nor is it any longer obedient to the laws of the circulation; but ſtagnates, and by the warmth of the parts naturally inclines to a ſtate of putrefaction. For the parts of animals putrefy, tho' confined in a cloſe place, cut off from any communication with air; only they corrupt then more ſlowly. We alſo obſerve, that all our humours become thinner by putrefying; for though blood immediately congeals after it is taken from a vein, yet at length it entirely diſſolves when it begins to putrefy. The cyſtic bile, which is always thicker in healthy quieſcent animals, does yet become thin and fluid by putrefaction. Therefore when clean and laudable matter is too long confined in an abſceſs, it loſes its unctuoſity and balſamic thickneſs by which it almoſt reſembles the cream of milk, and is changed into a thin ichor. Now, this great tenuity, ariſing from putrefaction, is always accompanied with a greater acrimony, as we ſaid in the commentaries on §. 86: The whole internal ſurface therefore of the cavity in which the attenuated and acrid matter is confined will be continually macerated and corroded by the ſharp ichor, the ends of the ſmall veſſels will be diſſolved, and their extravaſated humours will acquire the ſame kind of corruption; ſo that the ſides of the containing cavity being continually eroded, the ſinus of the abſceſs will be always increaſing, and the quantity of matter will be enlarged by the humours derived thither from the eroded veſſels. There are innumerable and evident obſervations to be found in the moſt approved authors, which prove that the ſolid parts of the body may be conſumed or corroded by the matter which has been too long confined

fined and rendered putrid. The lungs have been so much consumed after an empyema, that there were scarce any remains of that important viscus to be seen, as we read in Schenckius [a]. The same author also has an observation of the compact substance of the heart itself, and its pericardium, being dissolved or corroded by matter [b]. And most surgeons lament frequently, that the solid bones are corroded and rendered carious by corrupt matter in deep suppurations, *&c.* Hence the reason is evident why Hippocrates [c] pronounced that most empyematic patients might recover, in whom there is a discharge of white and pure matter, after the operation performed either by incision or cauterization; but that if the matter was discharged bloody, filthy, and ill-smelling, they must perish. As [d] he also observes, in an abscess of the liver, that the patient will perish if a foul matter is discharged when he makes water; for in that case the substance of the viscera being corroded by the matter, renders the case extremely dangerous.

Besides this, as an inflammation is the most frequently seated in the tunica adiposa, as we said before at §. 374; therefore a suppuration arising from the inflammation will be seated in the same part. Now the very tender fabric of this membrane may be very easily corroded by matter which is become acrimonious; even the matter may so distend this very easily dilatable membrane by its weight and bulk, that it may make itself new passages and sinuses of the worst kind. In the commentary on §. 244. and 300, nº 5. it was demonstrated, that the air entering the panniculus adiposus, sometimes produced a surprising emphysema or windy tumour, in which the whole body was in a manner buried; from whence it appears, that there is a ready passage from any one part of this membrane into all the rest of its extent. Thus I have seen, for want of discharging the matter which was formed by a suppuration of the parotid gland, that it has made itself

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[a] Observ. Medic lib. ii. p. 251. [b] Ibid. p. 274.
[c] Aphor. 44. sect. 7. Charter. Tom. IX. p. 315.
[d] Ibid. Aphor. 45. sect. 7. p. 316.

a way downward, through the panniculus adipofus of the neck, to the ſhoulder, arm, and even to the bending of the elbow; inſomuch that the ligaments which connect the articulation of the elbow were ſo corrupted as afterwards to produce an incurable anchyloſis. An abſceſs was formed, after a deep inflammation, round the articulation of the femur; and as the matter concealed under the large muſcles could not be evacuated, it deſcended, and formed a ſinous ulcer, running through the whole length of the thigh and leg: whence the robuſt youth was deſtroyed by a purulent cacochymia, after ſuffering the moſt tedious afflictions, and trying all means to no purpoſe. If now we alſo conſider, that the matter collected in the cellular membrane is attenuated by the warmth and ſtagnation, and that it often lies under ſtrong muſcles, it is very evident, that, being preſſed by the motion of thoſe muſcles, it may be propelled through all the adjacent parts, and by that means produce ſinuſes and fiſtulæ of the worſt kind, more eſpecially when the matter inſinuates into the cellular membrane which is interpoſed betwixt the muſcles themſelves. Now according as the tunica adipoſa is of a greater thickneſs, or as there are a greater number of ſtrata of muſcles lying over each other, in the ſuppurated part, ſo much the worſe ſinuſes or burrows may be formed by the too long confined matter: and hence it is that ſuch troubleſome fiſtulæ and ſinuſes are ſometimes obſerved in the abdomen, by reaſon of the great quantity of fat there ſeated and interpoſed betwixt the ſeveral ſtrata of the abdominal muſcles, as we obſerved before in the commentary on §. 307.

There is no part of the body in which there are worſe fiſtulæ and ſinuſes formed by matter being too long confined, than about the inteſtinum rectum. For as the groſſeſt fæces muſt paſs through that inteſtine to be diſcharged, it was neceſſary that it ſhould be capable of an eaſy dilatation every way; and therefore there is a large quantity of ſoft fat placed all round this inteſtine, into which the confined matter which has been too long retained in an abſceſs may penetrate and form ſinuſes: *For*, as Hippocrates obſerves, *the*

the matter corrupting eats away the ſoft parts, becauſe the inteſtinum rectum is moiſt, and its parts ſoft, in which the abſceſs burrows, until the tumour breaks, and putrefies downwards towards the inteſtinum rectum [e]. If now the rectum itſelf is alſo corroded, the matter may ſpread itſelf through the cellular membrane and mucilaginous cryptæ, *&c.* of that inteſtine, ſo as to produce moſt tedious maladies, which are ſtill much increaſed by the foulneſs of the inteſtinal fæces which are to paſs this way. Hippocrates, fearing theſe diſorders, would not have a maturation of the tumour to be waited for, but would have it opened as ſoon as poſſible, even though crude [f].

Or by diſſipation of the more thin juices, *&c.*] This ſometimes happens to an abſceſs, though but ſeldom, and eſpecially when it has been treated with very hot medicines without the addition of emollient and moiſtening ingredients. Thus it is cuſtomary with the women to expoſe a ſuppuration of their breaſt to the heat of a burning coal, to avoid having the abſceſs opened by the lancet of the ſurgeon. In that caſe, the more thin juices being diſſipated, the remainder is compacted into a ſcirrhus, which will be in danger of turning to a cancer, as too often happens. The like hardneſs frequently remains after venereal buboes have been opened before their time, or have been treated with remedies too hot. The caution of Galen is therefore here ſeaſonable, which he gives in treating on the cure of a phlegmon or an eryſipelas, when a ſcirrhus might be feared from thoſe diſorders: for he ſays, *But if any one attempts to evacuate with medicines which draw or diſcuſs too violently, without adding thoſe with moiſten as well as warm, and mollify as well as diſſolve, he will imagine the cure goes on very well for the firſt few days, but yet that which is left of the diſorder will prove incurable. For all that matter being diſcuſſed, which*

[e] Putreſcens enim mollia depaſcitur, quum inteſtinum rectum humidum ſit, et caro mollis, in qua pabulatur, donec tuberculum rumpatur, et infra verſus inteſtinum rectum computreſcat. *Hippocrat. de Fiſtulis, cap.* 1. *Charter. Tom. XII. p.* 141.

[f] Ibid. cap. 2. p. 142.

which consisted of thin particles, the remainder is left like a stony concrete [8].

Or, lastly, in the sanguiferous or lymphatic veins, *&c.*] It was said before in the commentary on §. 158, no 7. that matter was formed in wounds by an extravasation of the humours from the broken ends of the vessels, which were inspissated either by a dissipation or an absorption of their more fluid parts by standing. For if a wound is cleansed every hour, we shall not find any matter, but only a thin humour, which would become matter within the space of twelve hours. But the more fluid parts of the extravasated humours seem rather to be absorbed by the mouths of the veins, than to be dissipated externally: because laudable matter is not usually formed, unless the wound is well covered by some plaster or ointment; and we know that there are the mouths of the divided veins, as well as of the small arteries, opening throughout the whole surface of the wound, which may drink up the contiguous juices by that power with which very small glass tubes attract liquors, and, by transmitting them afterwards to the larger veins, may at last mix them with the blood. In the same manner likewise, when matter has been too long confined in an abscess, it naturally becomes much thinner; and, putting off its mild balsamic nature, it becomes acrimonious; and then, being absorbed by the contiguous orifices of the veins, infects the blood with a purulent cacochymy, whence a hectic fever and a consumption follow. That matter confined in any cavity of the body may be thus absorbed by the mouths of the veins, and mixed with the blood, we are taught by many observations. A certain nobleman was shot through the fore-arm with a bullet in the time of battle, by which the bones of the cubitus were fractured, whence a continual fever and many bad symptoms followed; and at the same time a large abscess

[8] Quod si quis vehementer trahentibus et discutientibus medicamentis vacuare tentet, nec iis, quæ humectent et calefaciant, molliat ac liquet; huic paucis primis diebus pulchre successisse curatio videbitur; illud vero, quod de affectu restabit, insanabile erit. Si quidem toto, quod in eo erat tenuium partium, discusso, quod reliquum est, velut lapidosa concretio linquetur. *Method. Med. lib.* xiv. *cap.* 4. *Charter. Tom. X. p.* 322.

abſceſs invaded the wounded and adjacent parts. When the ſurgeons were about to open the abſceſs, which they now thought mature, the patient was ſeized with a profuſe diarrhœa, and immediately all the tumour of the limb ſubſided, a large quantity of matter being viſibly diſcharged in the patient's ſtools: And when afterwards there was more matter formed in the abſceſs, that matter alſo diſappeared upon a return of the diarrhœa; and in this manner was that dangerous wound cured [h]. Scultetus [i] tells us, that he ſaw a large quantity of matter voided with the urine, in a man who was wounded in the abdomen; by which all the ſymptoms were relieved. Galen [k] alſo obſerved an abſceſs of the lungs voided by urine, and one of the thorax diſcharged by ſtool. A vomica of the lungs, attended with a diſtortion of the ſpine, has been obſerved [l] to be cured by a purulent dyſentery continued for ſeveral days; and this notwithſtanding the weakneſs and many bad ſymptoms perſuaded the moſt expert phyſicians that there was no further hope remaining; ſo that the girl was not only in a manner ſnatched from the jaws of death by this flux, but alſo the diſtortion of the ſpine mended of itſelf. In the ſmall-pox, how often do we obſerve, that the abſorbed matter excites a fever of the worſt kind? and that afterwards the matter being depoſited in different parts of the body, ſuddenly produces tumours; which being opened, diſcharge a true matter, and ſometimes degenerate into ulcers of the worſt kind? In ſhort, there are an infinite number of obſervations given us by authors of the beſt credit, which demonſtrate that matter being too long confined may be abſorbed by the veins and mixed with the blood, ſo as to be afterwards depoſited in ſeveral other parts of the body. It is alſo evident from thoſe obſervations, that the event of this tranſlation is very doubtful and various, according to the nature of the particular parts in which the matter is depoſited from the blood. For though, in the preceding caſes, the matter

[h] Belloſte Chirurg. d'Hopital. part. 3. chap. 15. p. 264.
[i] Armament. Chirurg. obſ. 61. p. 245.
[k] De Locis Affectis, lib. vi. cap. 4. Charter. Tom. VII. p. 517.
[l] Acad. des Sciences, l'an 1731. Mem. p. 724. &c.

ter was happily discharged by urine or stool; yet there was always great danger of its corrupting some of the viscera, or of depraving the whole mass of blood with which it mixes, so as to produce incurable diseases. For the matter collected in an abscess which is not opened, can scarcely be absorbed until it is first attenuated and rendered acrimonious; and when it afterwards flows with the blood through the vessels, it acquires a still greater acrimony; whence fevers of the worst kind, a corruption of the blood itself, and an infinite number of diseases follow. From hence we often observe in the small-pox, that when every thing is thought to be secure, a high frenzy suddenly arises, by which the patient is soon taken off unexpectedly; namely, from an absorption of the matter, and a translation of it to the brain. Hippocrates relates the case of a patient, in which there seems to have been something of this nature. For he describes the patient as afflicted with an internal suppuration of the thorax accompanied with a stertor, or wheezing, which, with the difficulty of respiration, seemed to indicate that a large quantity of matter was collected within. But, says he, *about the sixtieth day, the left eye was blinded with a tumour, but without pain; nor was it long after before the right eye and its pupilla became very white and dry: and in a little time after this blindness, not more than seven days, the patient expired with a stertor and light-headedness* [m]. For it seems very probable that the absorbed matter was by an unhappy translation carried first to the eyes, and then to the brain, by which it destroyed the patient. It is therefore evident, that different diseases will arise according to the particular nature of the viscera upon which the matter is deposited; and as the same matter either compresses or corrodes the adjacent parts which lie contiguous, it may either disturb or totally destroy their functions. From hence it is also evident, that the greatest prudence is required

m Prope sexagesimum autem diem oculus sinister cum tumore excæcatus fuit, sine dolore; neque longe postea etiam dexter oculus, pupillaque admodum candidæ et siccæ fiebant: neque multo post hanc excæcationem mortuus est, non ultra septem dies, cum stertore et multa desipientia. *Epidem. lib.* vii. *Ægrot.* 30. *Charter. Tom. IX. p.* 565.

in conducting this matter: for if the abſceſs be opened before it is arrived to maturity, it may occaſion many bad conſequences, as was ſaid in the commentary on §. 404; and if a diſcharge be not procured to the formed matter, then alſo the moſt fatal conſequences may attend. But the ſigns of a perfect maturation, with the treatment neceſſary to procure it, were deſcribed in the preceding aphoriſm.

It is from this abſorption of the matter that thoſe ſo frequently periſh, who have received a large wound, which daily affords a large quantity of matter; as when an aneuriſm has been cut out, or a limb amputated, *&c.* For if, in theſe caſes, the matter be frequently wiped off from the ſurface of the wound where it is collected, the body will be deprived almoſt of all its nouriſhment, which will be that way diſcharged, ſo as to deſtroy the patient with a true maraſmus. If, on the other hand, the matter is left longer upon the ſurface of the wound; by being abſorbed, it will produce a purulent cacochymia, with all its conſequent maladies, unleſs the matter is waſhed out from the blood by drinking large quantities of deterging vulnerary decoctions. But ſometimes the patient's ſtrength is ſo weak as not to be capable of bearing a large quantity of ſuch decoctions, without being thrown by them into a dropſy, and in that caſe the event is almoſt conſtantly unhappy.

§. 407. THE integuments of the part ſuppurated, with ſuch as are adjacent, muſt be mollified, attenuated, and relaxed, within and without, by the application of the ſame remedies (403.)

When an inflammation cannot be cured by a mild reſolution, the beſt method then remaining is to procure a ſuppuration; to obtain which, thoſe curative indications are required, enumerated at §. 402, and compriſed there in ſix numbers. For, in the firſt place, the crude inflammatory matter is to be brought to perfect maturation; concerning which we have already treated

ed, as alſo concerning the ſigns by which we may be aſſured that the maturation is completed; and in the preceding aphoriſm, we enumerated thoſe ill conſequences which are to be feared when a mature abſceſs full of laudable matter is not opened in time. The ſecond curative indication was to mollify the part to be ſuppurated, with thoſe adjacent, (ſee §. 402, nº 2.) concerning which we are to treat in this aphoriſm.

We obſerved, that an inflammation is moſt frequenly ſeated in the panniculus adipoſus, or *cellular membrane*, as it is ſometimes called, (ſee §. 374); which membrane is covered externally with a thick ſkin and its cuticle, both which are to be cut through, or naturally divided, in order to make a way for the diſcharge of the matter; whence it readily appears, that it is in this caſe highly neceſſary to relax and mollify the integuments. But thoſe remedies which were recommended in the commentary on §. 403. for bringing the crude inflammatory matter to maturity, will alſo be ſufficient for this purpoſe: for thoſe glutinous ſubſtances recommended at nº 2. of that aphoriſm, which ſtop up the pores, have at the ſame time a power to relax and mollify the ſolid parts. While therefore ſuch cataplaſms or fomentations are applied externally to the part to be ſuppurated, the integuments are as it were macerated and diſſolved without, while at the ſame time the matter excited to action produces the ſame effect within; all which is ſtill further promoted by that heat which invades the ſuppurating part, (ſee §. 403, nº 1). Nothing more therefore ſeems to be neceſſary to accompliſh this curative indication.

§. 408. ALSO by theſe means (407) the reſiſtance of the integuments is diminiſhed, while at the ſame time the matter formed by the maturative remedies (403) is either drawn or thruſt outward.

The matter now formed, and confined in a cloſe place, in which it is daily increaſed, being preſſed by

the adjacent parts, will by the laws of fluids tend that way where it meets with the leaſt reſiſtance. If now the integuments are ſo much weakened or relaxed by the application of the moſt emollient remedies that they may very eaſily give way to the diſtending matter, that matter will elevate the integuments and tend outwards, without making itſelf any ſinuous paſſages into the adipoſe membrane. All thoſe remedies therefore which were recommended for maturating the crude matter of the inflammation, will alſo attract or give the formed matter a tendency outwards. For it was proved in the commentaries on §. 134. that attractive remedies were ſuch as diminiſhed the reſiſtance in any part towards which the humours were to be derived.

§. 409. AND then things which are moderately acrid, emollient, and oily, are to be mixed and applied together, that the dead integuments may be more eaſily opened and without pain.

A diſcharge is to be procured to the matter confined under the integuments; which therefore requires them to be divided, either by perforating with a lancet, or elſe by a ſpontaneous and gradual laceration made by the diſtending matter. But to effect this with the leaſt pain, the moſt emollient and oily ſubſtances are to be applied, by which the integuments may be ſo extenuated as to be almoſt deſtitute of ſenſe like a dead part. Therefore, when an abſceſs is almoſt arrived to a ſtate of maturity, and riſes up to a ſharp point, ſurgeons uſually apply a pledgit ſpread with baſilicon or ſome other very ſoft ointment, to mollify the integuments in the moſt protuberant part; for by thus relaxing the fibres, the pain is diminiſhed, (ſee §. 228. nº 1.) which is generally ſevere enough in that prominent part of the tumour. Sometimes alſo there is a quantity of ſome moderately acrid ſubſtance mixed with the emollients, as yeſt, Venice ſoap, honey, *&c.* which in ſome degree erode or deſtroy the macerated integuments, and occaſion them to divide ſooner. Thus waſher-women, who

who have been macerating their hands all day in ſtrong ſoap-ſuds, have the ſkin of their fingers white and almoſt dead, inſomuch that it frequently peels off. Forms of ſuch like remedies as are here required may be ſeen in the Materia Medica correſponding to this aphoriſm.

§. 410. IN the next place, the matter being diſcreetly preſſed towards the riſing part of the tumour, the ſcalpel or lancet is then to be entered into the lower part of the whiteſt, ſofteſt, and moſt prominent point of the abſceſs, until the diſcharge of matter demonſtrates that the knife has entered ſufficiently deep; which is then to be raiſed in an even manner ſo as to cut through the integument with a longitudinal inciſion; or elſe, by entering the point of the knife through the oppoſite part of the tumour, the middle of the integuments is to be cut through, avoiding at the ſame time the fibres and veſſels: after this the abounding matter is to be gently preſſed out, at ſeveral times ſucceſſively; taking care not to offend the wound either by admitting the air, or by the uſe of tents.

When the whole circumference of the part appears ſufficiently mollified, and all the ſigns denote that the maturation is completed; if then the integuments do not open of their own accord, a diſcharge of the matter is to be procured by art, to prevent it from inducing thoſe conſequences which we mentioned at §. 406. But, in glandular parts, an abſceſs is to be left longer before it is opened than in other parts; becauſe there is here greater danger of a ſcirrhus, if any part ſhould be left behind which has not yet been brought to a maturation. Hence Celſus, in treating of the opening of abſceſſes, obſerves, *If indeed the matter ſhould come to maturity in the arm-pits or in the groins, it ought ſeldom to be diſcharged by inciſion: and the ſame is alſo to be univerſally obſerved when the abſceſs is but moderate, and*

when the diſorder is ſeated either in the external ſkin or in the fat, unleſs the weakneſs of the patient ſhould require it to expedite the cure. It is in theſe caſes ſufficient to apply cataplaſms, by which the matter may make its own way; for the part which has not ſuffered the action of the knife or cautery may remain with little or no ſcar after the cure[a]. From whence it appears, that the ſpontaneous apertion of the abſceſſes is not only preferable when they are ſeated in glandular parts, but alſo when they are in danger of producing any deformity by a ſcar. But then a wound made by a lancet may be afterwards better healed, than if a larger portion of the ſkin was to be deſtroyed or waſted by the contained matter. But why Celſus ſhould obſerve that an unſightly ſcar often remains after an abſceſs has been opened by an inſtrument of iron, is very apparent from what follows in the ſame place: for when the matter is lodged very deep, he orders the abſceſs to be opened by an actual cautery; and otherwiſe, when the ſkin is very much extenuated, he would have all that part of it cut out which covers the matter. He likewiſe extirpates the ſkin in the ſame manner when it looks pale; as, he ſays, it would afterwards become dead and uſeleſs.

To procure a diſcharge to the matter which is collected in a mature abſceſs, we muſt endeavour to perform it with as little trouble to the patient, and with as little danger and injury to the adjacent parts, as we poſſibly can: for we are to divide no more than the common integuments, that are diſtended and elevated by the matter confined beneath. Hence it is uſual for ſurgeons to preſs very gently with their fingers upon the whole circumference of the ſuppurated tumour, in order to make the integuments recede as much as poſſible from the ſubjacent parts: and as ſome part of the tumour is generally raiſed to a point, as was ſaid at §. 405. therefore the ſcalpel is to be entered principally into that part, as the integuments are there more extenuated,

[a] Si pus maturuit, in alis quidem et inguinibus raro ſecandum eſt: item ubicumque mediocris abſceſſus eſt: item quoties in ſumma cute, vel etiam carne vitium eſt, niſi feſtinare curandi imbecillitas cogit. Satiſque eſt cataplaſmatibus efficere, ut per ſe pus aperiatur, nam fere ſine cicatrice poteſt eſſe is locus, qui expertus ferrum non eſt. *Lib.* vii. *cap.* 2. *p.* 408, 409.

tenuated, and, being almoſt dead, may be eaſily perforated almoſt without pain, eſpecially if that point of the tumour has been before treated by the application of moderately acrid and fat ſubſtances, as we directed under the preceding aphoriſm. But to do this with the more advantage, the inferior or moſt depending part of the tumour is to be choſen for the aperture, that the matter may be diſcharged by its own weight: but in this, attention muſt be alſo given to the poſture which the part will require after the opening has been made. *For*, as Celſus obſerves, *we muſt endeavour to let the ſinus have an opening at its bottom, leſt any humour ſhould be confined within, and inſinuate itſelf farther, by corroding the adjacent parts which are as yet ſound*[b]. But if the point of the abſceſs is arrived at maturity in its upper part, and the integuments appear there ſofteſt and whiteſt, it will be beſt to make the opening in that part, rather than in one which is more depending, but has its ſkin as yet inflamed and very painful, ſo that it cannot be divided without frequently producing much trouble to the patient and the ſurgeon. For the opening being made, the matter may be entirely diſcharged from the abſceſs, and prevented from making any ſinuous paſſages through the panniculus adipoſus, by changing the ſituation of the part, with a gentle compreſſion, and a judicious application of compreſſes and bandage, according to the nature of the part.

So ſoon as the knife has penetrated the integuments, it enters into the middle of the purulent matter, which then immediately diſcharges itſelf by the ſides of the knife, more eſpecially if the integuments were at the ſame time ſtretched by a gentle preſſure upon the ſubjacent matter. But when there is a very large quantity of matter, it is beſt to enter the knife pretty deep, that the wound may be afterwards enlarged by an even inciſion made in elevating its point. For the ſame reaſon likewiſe, when it may be ſafely performed, the knife is thruſt from one ſide of the prominent part of the abſceſs through to the other; and then, by elevating it, the

b Danda (enim) opera, ut imus ſinus exitum habeat; ne quis humor intus ſubſidat, qui proxima et adhuo ſana rodenda ſinuet. *Ibid.*

the ſuperincumbent integuments are divided at once, to make the opening the larger, which can never be prejudicial. For unleſs the opening is made thus large, very great portions of the cellular membrane will be thruſt out, almoſt in a gangrenous ſtate, together with the matter; whence the aperture will be obſtructed, and a new inciſion again required. Add to this, that when the matter is diſcharged, the integuments which were before diſtended, will be contracted into wrinkles, ſo as very much to diminiſh the opening which has been made; and therefore it may be taken almoſt for a general rule, Always to make the inciſion as large as poſſible in the opening of an abſceſs, provided it can be done without danger of injuring the ſubjacent parts. But when the matter is lodged immediately under the ſkin, it is very evident that then there will be no need to enter the knife to any conſiderable depth. But ſometimes the greateſt caution is neceſſary, when the matter is concealed in parts very remote from the ſkin: for it will be bad to make an inciſion upon an abſceſs, without obtaining the diſcharge required; but it will be often more dangerous to enter the knife deeper into the part than was at firſt thought neceſſary; and therefore, in ſuch difficult caſes, great ſkill and dexterity are requiſite. For unleſs the ſurgeon is well acquainted with the ſituation of the parts from anatomy, he will be always either trembling with a vain fear, or elſe with a raſh aſſurance he will deſpiſe the danger of which he is ignorant. For as an inflammation is ſeated moſt frequently in the panniculus adipoſus, as we have ſeveral times obſerved before, and as that membrane inſinuates itſelf betwixt all the muſcles; it is evident, that the matter may ſometimes lie very deeply concealed, without cauſing any apparent defect in the integuments. The ſigns of a deep inflammation having preceded, and having been afterwards attended with the ſigns of a conſequent ſuppuration, with a fluctuation of the matter upon preſſing the part, will afford ſome light into thoſe obſcure places. A very remarkable caſe of this nature is related by the celebrated Le Motte. A woman was confined to her bed for nine months

months after a ſuppreſſion of her lochia, being obliged to continue with her body inflicted, in order to leſſen the very acute pains; for ſhe always continued in the ſame poſture day and night, with her heels drawn up towards the nates, and her face bowed down to her knee. As the pain was ſeated chiefly in the middle of the hypogaſtric region, betwixt the navel and the pubes, therefore a more diligent examination was made in that part, by which the ſurgeon perceived a ſort of undulation, though there was neither hardneſs nor tumour, nor any kind of change in the colour of the integuments. But by long experience, he determined, from his knowledge in other diſeaſes of the like nature, that there was here concealed a deep abſceſs, which was the cauſe of all the maladies: and though he was oppoſed by four ſurgeons who had attended the unhappy woman before, yet he inſiſted upon making an opening in that part; which with great caution he performed, till he had penetrated into the cavity of the abdomen. But notwithſtanding this opening was made, no matter could be diſcharged, even though the abdomen was compreſſed, the patient held her breath, and the poſture of the body was altered. The excellent ſurgeon being aſtoniſhed at his ill ſucceſs, went away, privately derided by the other ſurgeons, and candidly confeſſes that he did not ſleep all the night. The next morning, upon removing the apparatus which was applied the day before to the wound, he had the ſatisfaction to ſee a large quantity of matter diſcharged, though he could not underſtand where it lay concealed. The matter continued to diſcharge itſelf daily for about the ſpace of ſix weeks, and the woman by that time perfectly recovered of ſo deſperate a diſorder. She afterwards bore children, and was able to walk very well; only inclining a little towards the right-ſide, where the diſorder had been ſeated [c]. I remember to have ſeen a caſe of the like nature, when a ſurgeon opened a deep abſceſs in a woman's breaſt, which did not diſcharge ſo much as one drop of matter, although the ſcalpel had entered to the depth of above an inch; but yet, a few hours

[c] Traite Complet de Chirurgie, Tom. I. p. 280.

hours after, a large quantity of matter discharged itself spontaneously through the opening. From hence it is evident, that the diagnosis in such a case ought not easily to be changed immediately, when, after maturely considering all the circumstances, it is concluded that the part ought to be perforated or laid open; for although the point of the scalpel should not have penetrated into the cavity of the matter, yet the matter will be afterwards derived towards that part, as there will be there a less resistance.

Avoiding the fibres and vessels.] If the confined matter is lodged immediately under the skin; or if, as Celsus [d] terms it, the matter is *conjoined* to the skin; it is evident enough that there can be no danger of hurting any considerable fibres or vessels, as the matter elevates the skin from the subjacent parts; nor has it ever yet appeared that a true suppuration has succeeded in the substance of a muscle, but that it is always lodged in the panniculus adiposus: for though Ægineta [e] says, That an abscess is the corruption or alteration of the flesh or fleshy parts, as the muscles, veins, and arteries; yet we are taught by daily observation, that after the panniculus adiposus has been consumed by large suppuration, or even gangrenes, yet the muscles have appeared extremely clean and entire. It is indeed true, that we sometimes observe extraordinary changes, not only in the tunica adiposa, but also in the substance of the muscles themselves: but then, upon opening such a tumour, there is a discharge not of matter, but of a liquor of a different kind; whence it would seem, that those disorders ought not to be ranked among the class of suppurations or abscesses. A remarkable case of this nature is related in the Edinburgh Medical Essays [f], of a woman who had a tumour for some months upon the external part of the leg, more prominent and soft in the middle, with a manifest fluctuation when it was pressed by the fingers. As the skin of the part looked red, was attended with an acute pain, a hectic fever, night-sweats, and a diarrhœa returning every third day, *&c.* it seemed advisable to incise

[d] Lib. vii. cap. 2. p. 409. [e] Lib. iv. cap. 18. p. 64. [f] Vol. I. p. 234.

ncise or open the part. And therefore, after matu-
ating cataplasms had been applied for two days, and
he integuments were much extenuated, so that an e-
ident fluctuation might be perceived, an incision was
hen made sufficiently deep, to the length of an inch
nd a half; but though the tumour was thus opened,
t did not discharge a drop of matter, but there flowed
ut about two or three ounces of mucus. On the day
ollowing, a fungous mass appeared, sprouting up thro'
he opening; which being removed, grew again; and
after a large quantity of this substance had been cut off,
he probe, upon being introduced, passed quite thro' the
substance of the leg till it touched the skin on the op-
posite side. A few days afterwards the woman died,
and the skin of the affected leg appeared sound; but
the panniculus adiposus, together with the muscles,
were changed into a fungous mass, so that none of the
muscles could be distinguished, even by a diligent ex-
amination. The periosteum had here receded on all
sides from the bones. From this case it is evident,
that the muscles may be changed into a shapeless mass
by diseases; but yet there was no matter found there,
which is very remarkable. Perhaps Hippocrates
might intend the same kind of abscess, when he says,
*But to speak in brief, all other parts which are mucous
or produce a mucus, as being glutinous when they are
touched, suddenly slip from under the fingers to this or that
part, and therefore the physicians find the matter seated
deeper than they imagined*[g]. For in this place he treats
of a fracture of the ear, followed with a suppuration;
and observes, that if the incision ought to be made, it
should not be small, because the matter is more deeply
seated than one would imagine: and a little before he
observed, that cataplasms applied to the ear were pre-
judicial, as they excited abscesses, with a great deal of
mucus and troublesome suppurations; and then he sub-
joins the sentence which we have just quoted from him.

There

[g] Verum, ut summatim dicam, cætera quoque omnia, quæ mucosa sunt, et mucos producunt, utpote glutinosa, ubi tangantur, subito in hanc vel illam partem sub digitis elabuntur; quam ob rem profundius inveniunt hæc medici, quam putant. *De Articulis. Charter. Tom. XII. p. 363.*

There does not therefore seem to be much danger of injuring the fibres in opening a mature abscess; and therefore that caution is needless which is so largely described by Fabricius ab Aquapendente [h], almost in every part of the body of which he treats; that is, to make no incision but according to the course of the subjacent muscular fibres: for even that same author confesses afterwards in the same chapter, That even those who are ignorant of anatomy cannot err in the opening of an abscess, by reason of the quantity of matter which elevates the skin, and secures the subjacent parts from the knife [i].

The abounding matter is afterwards to be gently pressed out at several times.] In the larger sort of abscesses, in which there is a very great quantity of matter collected, it does not seem to be always safe to discharge the matter entirely at one and the same time. For all the parts which invest the abscess, were before very much compressed by the matter; and if they were freed from the pressure one moment, they would become very flaccid, and admit a great quantity of blood in their vessels, so that less blood would be sent to the brain and cerebellum, whence a fainting and death itself might follow. The same danger is also at hand, if a part is suddenly set at liberty from the pressure which it received from any other collected humour; whence Hippocrates observes, That those expire who have the water or matter all at once discharged, after the operation of perforating or cauterizing in an empyema or a dropsy [k]. But if the abscess is seated in such a part of the body, that the parts may be compressed by bandage, in proportion to the quantity of matter discharged, then the greatest evacuations may be performed with safety, as we shall shew when we come to treat of the cure of an Ascites by paracentesis. Nor will it be at all prejudicial to leave a quantity of matter in the abscess: for its cavity, being thus covered as it were with a natural balsam, will be fomented and deterged; the half-dead ends of the vessels

[h] De Chirurgicis Operat. cap. 107. p. 654.
[i] P. 662.
[k] Aphor. 27. Sect. 6. Charter. Tom. IX. p. 263.

ſels will be ſeparated, and the whole better diſpoſed to heal, as we ſaid more at large in the Hiſtory of Wounds, §. 158. n° 7, 8, 9. Only it is neceſſary not to let ſo much matter remain as to hurt the parts by diſtending them, or ſo as to occaſion it to penetrate into the panniculus adipoſus; both which will be prevented, if the opening is left free, and made in ſuch a part of the tumour that the redundant matter may flow out by its own weight. Whence great caution is to be uſed, that the opened abſceſs

Be moleſted neither by the admiſſion of the air, nor by the uſe of tents.] After the abſceſs has been opened, even though all its matter was diſcharged, yet more will be collected there again in the ſpace of about four and twenty hours, and ſometimes ſooner, which will alſo require to be diſcharged in the ſame manner. Therefore ſurgeons, fearful leſt the lips of the divided abſceſs ſhould unite too ſoon, uſually introduce tents to prevent the orifice from concreting. But ſuch tents, formed of dry ſcraped lint, ſwell very much by abſorbing the contiguous humours; by which means, as they are of a conical figure, they are thruſt out in a little time; or elſe, if they are retained by the application of plaſters and bandages, they ſtop up the orifice like a cork, and prevent any diſcharge of the matter, which therefore endeavours to make itſelf new paſſages into the panniculus adipoſus, which is ſo eaſily dilatable. Beſides, theſe tents gradually lacerate and diſtract the lips of the opening, while they ſwell by abſorbing the humours; from whence a painful tumour and a new inflammation often ariſe. It is therefore evident that tents are in this caſe either uſeleſs or pernicious. Further, when the apparatus or dreſſings are renewed, and the tent is extracted to diſcharge the matter, there is then a paſſage given to the air into the empty cavity; and how pernicious the air may prove, by drying up the extremities of the tender veſſels, which are naturally open, has been ſaid in the commentaries on §. 204, 245.

The beſt method of all therefore will be to keep the opening always covered with a flat pledget, ſo that the matter may continually flow out with eaſe: taking care

alſo that neither the bandages nor plaſters preſs upon the orifice; but rather make a gentle preſſure upon the circumjacent parts, by an artificial application of compreſſes and bandage; and thus the matter may be derived towards the open orifice, which is free from any manner of preſſure. But the uſe of tents in open abſceſſes ſeems to have been long ago ſuſpected, even by Celſus, when he ſays, *For if any of them are ſeated either in the arm-pits or groins, they are to be incarned without lint. Alſo when in other parts the bottom of the opening is but ſmall, if the ſuppuration was but moderate or ſuperficial, and not attended with a fever or diſorder of body, the uſe of lint is even there unneceſſary. In others, lint is to be uſed but ſparingly, or not at all, unleſs the wound is large*[f]. See what has been ſaid concerning the ill effects of tents in the commentary on §. 299.

§. 411. LASTLY, the abſceſs is to be treated with medicines which mundify, ſuppurate, digeſt, heal, deterge, or dry, according to the different nature of the caſe, and agreeable to the doctrine of wounds from §. 192, to 220.

We come now to treat of thoſe curative indications which are mentioned in the two laſt numbers of §. 402; namely, in what manner the opened abſceſs is to be cleanſed and reduced to the ſtate of a clean wound. For the whole internal ſurface of the abſceſs has been macerated for ſome time in the confined matter, by which means it is almoſt conſtantly more or leſs diſeaſed, as was ſaid in the commentary on §. 402, n° 5. It will be therefore neceſſary to cleanſe this internal ſurface, and ſeparate all thoſe parts of the ſolids and fluids which are ſo far corrupted as to impede the union of the other ſound parts. But the ſurface of the abſceſs will be the foulеſt of all, if the matter, by being too long

[f] Tum, ſi qua in alis, vel inguinibus ſunt, ſine linamento nutrienda ſunt. In cæteris quoque partibus, ſi ima plaga exigua eſt, ſi mediocris ſuppuratio fuit, ſi non alte penetravit, ſi febris non eſt, ſi valet corpus, æque linamenta ſupervacua ſunt. In reliquis, parce tamen, nec, niſi magna plaga eſt, imponi debet. *Lib.* v. *cap.* 28. *p.* 327.

long confined, has changed its balsamic quality into an acrimony; for then it in a manner consumes the adjacent parts of the skin and panniculus adiposus: so that it would be impossible to unite or heal the parts thus foul before they are cleansed, as hath been very justly observed by Galen, who says, *But when the skin is so much extenuated in large suppurations, that it resembles the rags of a worn-out garment, it very difficultly unites with the subjacent parts; so that in order to the cure of the ulcer, its opening must be enlarged*[a]. But what remedies are required to depurate a sordid ulcer, and to reduce it to the state of a clean wound, has been declared before, in the History of Wounds, especially in the commentaries on §. 204, to 210.

§. 412. IF the patient is possessed with a needless fear of the knife, a caustic may be applied to the part which points (410); and the eschar, being softened with fresh butter, may be afterwards separated, and the rest of the treatment conducted as before, (410, 411.)

A mature abscess may be most safely opened by the scalpel: but sometimes the surgeon has to deal with a patient of so pusillanimous a disposition, as even to faint away at proposing the knife; tho', even in these cases, it is best to deceive the patient, and open the abscess by incision when it is not suspected. Various machines have been invented by surgeons for this purpose; as the concealing of a lancet in a ring upon their fore-finger; or else a lancet being fixed with its point thro' a plate of metal, the plate is then covered with some cataplasm or ointment, and being applied to the part, the business is easily performed, by pressing the point gently over the part to be divided. There are several other contrivances of this nature to be met with

[a] Quum vero cutis in suppurationibus amplius extabuerit, ita ut attritis vestium fragmentis similis reddatur (ως ῥακωδες γενεσθαι) difficulter subjectis corporibus coalescit; itaque emissario largiore facto ulcus necessario curandum est. *Method. Med. ad Glaucon. lib.* ii. *cap.* 9. *Charter. Tom. X. p.* 384.

in Parey [a] and others. But if even by this means the neceſſary opening cannot be made in a mature abſceſs, nothing then remains but to apply a cauſtic, or *potential cautery* as it is called by the ſurgeons, to the pointing part of the abſceſs. Of theſe cauſtics there are ſeveral kinds in the ſhops, ſuch as the lapis infernalis, or the common cauſtic compoſed of quick-lime and potaſhes, (ſee the Materia Medica correſponding to this aphoriſm), which are thoſe chiefly in uſe. Firſt, a plaſter is applied to the part, in which there is a ſmall aperture correſponding to that part of the ſkin to which the cauſtic is to be applied; to this aperture the cauſtic is then fixed, and retained by applying another plaiſter over the whole; and thus the apparatus is left on for an hour or two, or till the eſchar is burnt ſufficiently deep. After this the eſchar is ſeparated from the living parts, by dreſſing it with baſilicon, freſh butter, or the like; and then the matter is diſcharged through the aperture as before made, after which the cure may be conducted as where directed. In the mean time, it is certain, that thoſe who are afraid of the knife ſuffer more pain from the cauſtic: for a mature abſceſs is divided by the ſcalpel in a moment; whereas a cauſtic is obliged to lie upon the part an hour or two, or even longer; and, after all, there is ſtill a conſiderable pain felt when the eſchar is gradually ſeparated from the contiguous living parts; to which add, that a cauſtic uſually produces a greater deformity in the cicatrix.

Of FISTULÆ.

§. 413. FROM what has been ſaid, the origin, cauſe, nature, ſituation, and effects, of ſinuſes and fiſtulæ, may be underſtood (406.)

When we enumerated the ill conſequences from a too long retention of mature matter in an abſceſs, §. 406. we obſerved that the matter by its weight, motion,

[a] Livre VII. chap. 10. p. 167.

tion, and acrimony, might create ſinuſes and fiſtulæ of different kinds in different parts of the body. We are therefore to treat of theſe ſinuſes and fiſtulæ in the following aphoriſms.

The word *ſinus* is uſed among phyſicians and ſurgeons, to denote a cavity in the ſoft parts of the body, which have been removed from their contacts with each other, by the matter collected in an abſceſs, afterwards diſcharged either by a natural or artificial opening. For ſuch is the definition of a ſinus given by Galen in treating of this ſubject, when he ſays, *For when the part thus affected has no opening towards the external ſurface of the body, it is then ſaid to have* abſceded, *and the diſorder itſelf is termed an* abſceſs: *but when there is an aperture ſo as to diſcharge the contained humour, the diſorder is no longer called an* abſceſs, *but a* ſinus[a]. Now it appears from this definition, that a ſinus muſt neceſſarily follow after every abſceſs. But yet it has been cuſtomary only to call it a ſinus when the ſides of the abſceſs which has been opened and freed of its matter, do not unite ſpeedily together, even though they remain contiguous, but continue along time divided; and therefore there will be a collection of freſh humours made every day in that cavity, which will retard the cure. Hence we find the following definition of a ſinus given us by Galen in another place: *As the matter excoriates the parts, and ſeparates or diſſolves the containing parts from thoſe which are ſubjacent; then that matter being ſome way evacuated, the divided parts cannot recover their former continuity, and the diſorder is termed a ſinus* [b]. The like he alſo ſays in another place. For after having taken notice, as we ſaid in the commentary on §. 411, that the ſkin is ſo waſted in ſuppuration,

[a] Quoad enim pars ita affecta nullam aperturam habet verſus exteriorem ſuperficiem, abſceſſiſſe ipſa quidem dicitur; affectio autem abſceſſus vocatur. At ubi aliqua ex parte aperta eſt, ſic ut excernatur contentus humor, affectio non amplius abſceſſus, ſed ſinus jam appellatur. *Commentar. 2. in lib. Hippocrat. de Medici Officina, textu 27. Charter. Tom. XII. p. 64.*

[b] Quum corpora pus excoriat, et continentia a ſubjectis ſeparat ac diducit; deinde eo (pure) quomodocumque evacuato, ſeparata nequeunt priſtinam conſtitutionem recuperare, affectio ſinus appellatur. *De Tumor. Præternatur. cap. 4. Charter. Tom. VII. p. 316.*

puration, as to reſemble the fragments of a worn-out garment, and very difficultly unites with the ſubjacent parts; he then immediately adds, in the beginning of the following chapter, *As the ſkin can no more unite with the ſubjacent parts, ſuch a diſorder is called a ſinus* [c]. Even this ſame definition of a ſinus is given us, almoſt in the words of Galen, by Paulus Ægineta [d].

But a *fiſtula* differs from a *ſinus*, in that it is narrower, and generally of a longer ſtanding, having its orifice and internal ſurface frequently covered with a callus. Hence we have the following definition of a fiſtula given by Ægineta: *A fiſtula is a callous ſinus, generally ariſing from an abſceſs, and deriving its name from a reed-pipe* [e]. And in another place he adds, [f] that fiſtulæ generally ariſe from abſceſſes which have not been well cured. But the Latin Hippocrates, Celſus, having told us in a few words that fiſtulæ ariſe from abſceſſes and other kinds of ulcers, defines them by ſaying, *This is the name of a deep, narrow, and callous ulcer* [g].

Origin.] The riſe of ſinuſes and fiſtulæ is evident enough from what has been ſaid in the commentaries on §. 406. For a phlegmon being changed into an abſceſs, if its matter is too long confined, or diſcharged by too narrow or high an opening, ſo that it cannot eaſily eſcape, it gives birth to ſinuſes and fiſtulæ.

Cauſe.] That is, good matter by its weight and bulk making a paſſage into the cellular membrane which is very eaſily dilatable; or elſe the ſame matter corrupted by ſtagnating, and rendered ſo acrimonious as to corrode the adjacent parts.

Nature.] Conſiſting in a preternatural cavity amongſt the ſoft parts, removed from their uſual contacts by a collection of purulent matter, ichor, ſanies, *&c.*

Seat.] This is always in the panniculus adipoſus; nor

[c] Quum amplius ſubjectis finus corporibus cutis coaleſcere non poteſt, ejuſmodi affectus ſinus appellatur. *Method. Med. ad Glaucon. lib.* ii. *cap.* 10. *Charter. Tom. X. p.* 385.

[d] Lib. iv. cap. 48. p. 69. verſa.

[e] Fiſtula ſinus eſt calloſus, plerumque ex abſceſſibus naſcens, ducta ab arundineis fiſtulis tranſlatione appellata. *Lib.* iv. *cap.* 49. *p.* 70.

[f] Lib. vii. cap. 77. p. 93. verſa.

[g] Id nomen eſt ulceri alto, anguſto, calloſo. *A Corn. Celſ. Med. lib.* v. *cap.* 28. nº 12. *p.* 328.

nor do I know that it has ever appeared, from any credible obſervations, that the proper ſubſtance of the muſcles has been at any time pervaded by fiſtulæ. We obſerved in the commentary to §. 374. how largely the panniculus adipoſus is extended, ſo as to involve the whole body, and almoſt every particular part thereof; it being not only continued round the muſcles and tendons, but alſo inſerted betwixt the ſub-diviſions of the muſcles into their leſſer portions, even as far as the eye can trace them. From whence it is evident, that ſinuſes and fiſtulæ may often turn and wind in a ſurpriſing manner, and penetrate to a very great depth from their opening, as ſurgeons frequently find and teſtify by many obſervations. Thus a young man, aged twenty-two years, was troubled with a moſt acute pain, for above the ſpace of ſix weeks, which invaded the loins, inguen, and nates, of the right-ſide, obliging him to lie night and day upon his back, with his knees drawn up, and his feet bent towards the nates. After the beſt remedies had been uſed without ſucceſs, no change of colour could be obſerved in the ſkin of the painful parts, nor any alteration of their figure: but at the ſide of the vertebræ of the loins, there was a deep undulation to be perceived (like that of matter) betwixt the ſpine of the os ilium and the laſt of the falſe ribs. This part, being deeply inciſed with a ſcalpel to the length of near three inches, diſcharged above ſix pounds of pure matter: and an incredible quantity of matter was alſo diſcharged afterwards in the latter part of the ſame day, from the opening, which overflowed the patient's bed, unknown to him, but to the great relief of his pains. When the ſurgeon removed the dreſſings, and preſſed the abdomen, there was again a large quantity of matter diſcharged; and ſtill much more when the leg and thigh of the ſame ſide were compreſſed, though there was no apparent tumour in thoſe parts. On the following days, when all the matter had been diſcharged as near as poſſible by compreſſing the thigh and abdomen, there was ſtill a large quantity of matter again expelled by beginning a compreſſure at the foot and continuing it up

h De la Motte Traite complet de Chirurgie, Tom. I. p. 357, &c.

up to the knee [h]. From this surprising case it appears, that good matter may by its weight only, as it should here seem, make itself passages from the loins, down even to the bottom of the foot: insomuch, that though the whole habit of the patient's body was so wasted by this large suppuration that one might easily span or grasp the top of his thigh with one's hand; yet within five months after the opening made, he was perfectly recovered; and in two months more he entirely regained all that he had lost, and even seemed to be fatter than before he had the disease.

I saw a case of the like nature, which had not so successful an event. A soft tumour arose on the left side, even with the os ilium, and at about the distance of two fingers breadth from the spina dorsi, in a healthy, brisk and middle aged man, without any manifest cause. The late celebrated Boerhaave, being consulted, ordered the tumour to be divided by a large incision with a scalpel; but the fearful patient resisted immediately upon the first touch with the knife, and could not be prevailed upon either by his friends or the threatening events of his disorder to suffer the incision to be made an end of: for there was but a slight puncture made, which scarce entered the skin, so that no matter was discharged at that time; but yet by the application of emollient cataplasms for two days to the wounded skin, an incredible quantity of matter made its way out. As all the functions of the body appeared in good condition, there were great hopes of a cure; but the plentiful discharge of matter continued daily. The surgeon pressing the necessity of dilating the small opening, the patient, after delaying many days, at length consented; but did again prevent it from being enlarged so much as it ought, by the resistance he made upon feeling the pain, for he would not suffer himself to be held by any assistants. In the mean time the quantity of matter seemed to diminish for some days; but again, after a while, an exceeding large quantity of matter vented itself unexpectedly, almost like a torrent. The surgeon with much difficulty obtained leave of the patient to examine which way the sinus tended by his probe, which

which he could eaſily paſs upwards under the integuments to the ribs: and as the miſerable patient obſtinately perſiſted rather in ſuffering death, than to admit of an eaſy inciſion; therefore a new opening was made by the application of the common cauſtic to that part, where the end of the probe met with a reſiſtance. But though all proper treatment was given with compreſſes, bandages, a convenient poſture of the body, *&c.* it was yet to no purpoſe; for the matter continued diſcharging in ſuch quantities as to overflow the compreſſes, bandages, and even the bed itſelf. In the mean time the patient's body was waſted with a hectick fever, his appetite however remaining entire, and his bowels neither too much conſtipated nor too looſe. At length, being totally emaciated, after ſome weeks time a ſoft tumour appeared in the right inguen as high as the top of the os pubis; by opening which, ſeven pounds of clean matter were diſcharged: and yet there was alſo a continual diſcharge of matter from that aperture in the groin, as well as from the two others in the back; which at length ſo much exhauſted the patient, that he quietly expired, even though his appetite remained good to the laſt.

As I very much wondered from whence ſo large a quantity of matter proceeded, and could not imagine that it came from the cavity of the abdomen through the aperture in the groin, which was the opinion of the ſurgeon, though there was no apparent tumour of the abdomen, nor any defect in the chylificative organs throughout the whole courſe of the diſeaſe; I obtained leave therefore of the patient's friends to examine the body.

We introduced a probe through the two openings in the back, nor could we make it paſs to any conſiderable length: but when we entered the probe into the opening which had been made in the groin, it paſſed its whole length without uſing any force. After drawing out the probe, we introduced a leaden plummet thro' the ſame orifice, and paſſed it gently upwards till it met with a reſiſtance; and then, by laying open the tract of the probe by inciſion, we found that it paſſed not

not into the cavity of the abdomen, but that it went up backward above the psoas muscle, under the peritonæum and right kidney; nor could we find any communication betwixt this sinus and the two openings which were made in the back. In the cavities of the thorax and abdomen, there was not so much as a single drop of water to be found; and as we had not observed any disturbance in the functions of the brain during the whole course of the disease, we therefore refrained from opening the cranium. From hence it is sufficiently evident, that all this matter was lodged in the panniculus adiposus only, since none of the other parts appeared vitiated, and there were no apparant signs of a suppuration preceding, nor of any matter contained in the larger cavities of the body.

The effects of sinuses and fistulæ are like those which we enumerated in the commentary on §. 406. resulting from too long a confinement of matter in a mature abscess: For the matter being retained in sinuses and fistulæ, from whence it can hardly ever be entirely discharged, it is there attenuated and putrefied by standing, so as to degenerate into an acrid sanies; and this sooner than in a close abscess, because there is here an access given to the air. The sides therefore of sinuses and fistulæ will be greatly injured by this corrupt matter, which will so much alter them, that it will be afterwards very difficult to cleanse and reduce them to the state of a pure wound, which yet is absolutely necessary to procure an union of the divided parts; and the matter there residing will also prevent the union of the parts, by interposing like a foreign body. It is also from hence apparent, that fistulæ must be the worse conditioned as they are of longer standing, and as they approach nearer to some parts by an erosion of which we may justly foresee much danger or slowness and difficulty in the cure. Hence Hippocrates, treating of this subject, says, *Those fistulæ are very stubborn which are seated in parts cartilaginous and destitute of flesh; as are those also which are cavernous, and burrow into the parts, continually discharging an ichor: And there is generally a caruncle in the mouth of those fistulæ. But those are*

more

more eaſily cured, which are ſeated in ſoft fleſhy parts deſtitute of nerves [i]. A very accurate but ſomewhat fuller prognoſis of a fiſtula, is given us by Celſus, when he ſays, *The cure is ſhort in a ſimple fiſtula which is recent, and ſeated in the fleſh: The cure will be alſo aſſiſted by the body itſelf, if that is ſtrong and young. But the contrary of thoſe oppoſe the cure: which will be likewiſe difficult if the fiſtula has injured a bone, cartilage, nerve, tendon, or muſcle; as alſo if it is ſeated in a joint; or if it has penetrated to the bladder, lungs, womb, large arteries, or veins, or into the fauces, throat, ſtomach, or thorax. It is alſo conſtantly dangerous, and even frequently fatal, for a fiſtula to tend to the inteſtines. Fiſtulæ are alſo rendered much more malignant when the body is indiſpoſed by diſeaſe, old age, or a bad habit* [k].

§. 414. AN opened ſinus (413) may be eaſily diſcovered; but a cavity which is as yet cloſed, is diſcovered by the ſoftneſs to the touch.

We come now to inquire by what ſigns one may diſcover a preſent ſinus or fiſtula. Theſe diſorders are ſufficiently evident, when they open outwards in ſome external part of the body: For if a large quantity of matter is diſcharged from ſuch a ſmall opening, or may be forced out from thence by preſſure, it is from thence evident that there muſt be a large cavity for containing that matter. But to diſcover which way the ſinus tends, and how deep it penetrates, Celſus [a] orders

i Fiſtulæ difficillimæ ſunt, quæ in cartilaginoſis et carne vacuis locis ſiunt, cavæ ſunt, cuniculos agunt, et ichore ſemper manant. Caruncula autem in eorum oſculo eſt. Facilius autem curantur, quæ in mollibus, carnoſis, et nervorum expertibus locis contingunt. *Coac. Prænot.* nº 511. *Charter. Tom. VIII. p.* 882.

k Expedita curatio eſt in fiſtula ſimplici, recenti, intra carnem. Adjuvatque ipſum corpus, ſi juvenile, ſi firmum eſt. Inimica contraria his ſunt: itemque, ſi fiſtula os, vel cartilaginem, vel nervum, vel muſculos læſit; ſi articulum occupavit; ſi vel ad veſicam, vel ad pulmonem, vel ad vulvam, vel ad grandes venas arteriaſve, vel ad maxillas, guttur, ſtomachum, thoracem penetravit. Ad inteſtina quoque eam tendere, ſemper periculoſum, ſæpe peſtiferum eſt. Quibus multum mali accedit, ſi corpus vel ægrum, vel ſenile, vel mali habitus eſt. *Lib. v. cap.* 28. nº 12. *p.* 328, 329.

[a] Ibid. p. 329.

ders an examination to be made with a probe; and by the ſame method he would alſo have it diſtinguiſhed whether or not the fiſtula has penetrated to the bone, as alſo whether the bone itſelf is carious. But in order to be aſſured whether a fiſtula, opening with but one orifice externally, divides itſelf afterwards into ſeveral branches or ſinuſes within, he directs the following method to be taken: *An inclination of the body will demonſtrate whether or not a fiſtula penetrates into more parts than one: becauſe frequently, when a patient lies in a different poſture, or places the limb in a different manner, the matter which had ceaſed to diſcharge itſelf will again flow out; and not only teſtify that there is another ſinus from whence it deſcended, but alſo that the ſinus tends into another part of the body* [b]. But of all methods for diſcovering the capacity and different courſe of ſinuſes and fiſtulæ, the beſt ſeems to be by a prudent and gentle injection of warm water with a ſyringe. For the water will eaſily inſinuate into all the meanders of a fiſtula; and, if it tends outwards under the integuments, will demonſtrate its different courſe by elevating the ſkin into a tumour: but if the ſinus or fiſtula deſcends deep, the quantity of water injected will then only demonſtrate the magnitude or capacity of ſuch a preternatural cavity; nor can much more be diſcovered by the uſe of a probe: beſides, the probe, if rudely thruſt through the orifice of a fiſtula, often runs into and lacerates the panniculus adipoſus, ſo as to make ſinuſes which were not before; nor is it poſſible to diſcover the length of a fiſtula by this means, when in a turning or winding courſe.

But when a ſinus is as yet cloſed, the diagnoſis of it is ſtill more difficult, eſpecially if its ſituation is very deep: but ſome light may be had from the ſigns of inflammation preceding, and the marks of a ſuppuration following; and if, after theſe, a ſoftneſs and fluctuation is perceived by the touch, we may be certain enough

[b] Corporis inclinatio docet, num in plures partes fiſtulæ penetrarint; quia ſæpe, cum quis aliter decubuit, aliterque membrum collocavit, pus ferri, quod jam deſierat, iterum incipit; teſtaturque, non ſolum alium ſinum eſſe, ex quo deſcendat, ſed etiam in aliam corporis partem eum tendere. *Ibid. p.* 330.

nough that there is a ſinus. Add to this, that a ſuppuration of any moment ſeldom lies long concealed in any part of the body without producing a hectic fever. But great prudence is required in determining this matter, to avoid miſtaking a latent aneuriſm or a varix for a deep ſuppuration, which has ſometimes happened; but a ſkilful ſurgeon cannot eaſily run into ſuch an error, if he firſt carefully conſiders the origin and progreſs of the diſorder. It muſt however be confeſſed, that abſceſſes have been ſometimes obſerved ſo latent or deeply ſituated, as to occaſion the moſt ſkilful ſurgeon to be ſometimes in a doubt, as is evident from the extraordinary caſe mentioned in the commentary on §. 410, from the excellent ſurgeon La Motte, who has candidly deſcribed the caſe, with many others of the like nature.

§. 415. FISTULÆ are cured by opening them in their lower part; by filling their cavities with melted digeſtives, choſen according to the nature of the caſe; by the injection of deterſives; and by bandage gradually preſſing from the bottom upwards, or towards the opening: But the integuments are ſooneſt divided upon a director, or grooved canula; or by a ſilver wire; or, laſtly, by the ſyringotomus.

The cure of all ſinuſes and fiſtulæ, requires in general, 1. To procure a free paſſage to the matter, and to prevent it from ſtanding ſo long as to corrupt in the ſinus or fiſtula. 2. To cleanſe or deterge the internal ſurface of the cavity of the ſinus or fiſtula, and reduce it to the ſtate of a clean wound. 3. To bring the ſeparated parts now clean into contact, and retain them ſo as they may grow to each other. Now, when the two firſt requiſites are performed, the third may be eaſily obtained, as Celſus very well obſerves, when he ſays, *Nor is it to be feared that one clean part being joined to another, will not concrete, if medicines are alſo uſed which are efficacious for that purpoſe; for we ſee, that in ul-*

ulcerations of the fingers, if we do not take great care in their cure, they are joined into one [a]. The principal difficulty therefore consists in procuring a free exit to the confined matter, and in depurating the cavity of the sinus; for there are many cases in which this last is very difficult, and sometimes even impossible to attain. Thus I saw a fistula, with a narrow orifice opening in the anterior part of the left breast, which descended by a winding passage behind the cartilage of the rib; nor was it possible by any art to prevent the matter from stagnating in the bottom of this fistula, since the cartilage of the rib made a compression impracticable, and an opening of the fistula dangerous if not impossible. Celsus [b] indeed would have a part of the rib cut out in such a case, that no corrupt matter may be left behind; but I believe no one will readily cut out a portion of the rib in a living person, and afterwards pull it off from the pleura to which it firmly adheres. The patient now mentioned had undergone all methods that could be tried, but without success; and patiently bore the evil which could not be remedied, till at last it destroyed him in about two years after. Thus also, when a fistula has extended to the bone, and infected the same, the parts cannot be depurated before that portion of the bone is exfoliated naturally or removed by art. Such fistulæ very often occur about the jaws; which often continue years, and give way to no remedies: but after a tooth has been drawn, even a sound as well as a carious one, which, penetrating through the socket of the jaws, continually injured and irritated the adjacent soft parts, they are then often cured in a few days time. But for the cure of fistulæ, the following methods are principally recommended.

To open them in their lower part by incision.] If the orifice of the sinus or fistula is so placed that the humours contained in its cavity cannot discharge themselves by their own weight, the cure is always difficult; for they will be accumulated, and increase the preternatural

[a] Neque verendum est, ne purum corpus puro corpori junctum non coeat, adjectis quoque medicamentis ad id efficacibus; cum sæpe exulceratio digitorum, nisi magna cura prospeximus, sanescendo in unum eos jungat. *Ibid. p.* 332. [b] Lib. vii. cap. 4. nº 2. p. 412.

natural cavity. Therefore ſkilful ſurgeons always endeavour to make a new opening in the lower part of the ſinus, that the matter, ſanies, *&c.* may diſcharge themſelves ſpontaneouſly. But if they are doubtful in what part the bottom of the ſinus or fiſtula is ſeated, they ſtop up the orifice with a tent for the ſpace of twenty-four hours, in ſuch a manner that nothing can be diſcharged; and thus, by confining the humours, they make a tumour in the moſt depending part. The ſame thing is alſo performed by a prudent injection of warm water. By this method indeed the collecting humours are prevented from ſtagnating in the cavity of the ſinus or fiſtula; but then the whole internal ſurface very often remains foul, ſordid, or even callous; which therefore makes a depuration neceſſary.

By filling the cavity with liquefied digeſtives, choſen according to the nature of the caſe.] In what manner ſordes of the like nature formed in wounds are to be removed, has been ſaid in the commentaries on §. 207; and the ſame remedies will be here proper, either of a milder or more acrid nature, according as the ſordid parts are thicker, or the internal ſurface of the ſinus or fiſtula more or leſs callous. Now, in an open wound, it is very eaſy to apply theſe remedies to every point of their ſurface; but not ſo in a winding fiſtula. The ancient phyſicians uſed *collyria* for this purpoſe, by which name we are to underſtand a ſort of cone or tent: For notwithſtanding that term is at preſent generally uſed to denote thoſe remedies of the ſhops which ſerve for the cure of diſeaſes in the eyes, yet it was uſed in a more ample ſenſe among the ancients; for Gorræus [c] proves from the beſt authors, that κολλυριον is is as much as to ſay *a tail cut off* (κολοβη υρα). Thus Celſus alſo recommends a plaſter for the cure of ſimple and recent fiſtulas in the fleſh, which was applied for recent wounds, provided it contains ſome ſalt, allum, verdigreaſe, or ruſt of braſs, *&c.* And he then adds: *And of this a collyrium ought to be formed, ſmall at one end, and a little larger at the other: and this is to be introduced into the fiſtula, with the ſmalleſt end foremoſt,*

[c] Definit. Med. p. 324, 325.

till clean blood ſhews itſelf, &c [d]. The whole intention ſeems to have been by this method to apply ſuch medicines to every point of the internal ſurface of the ſinus or fiſtula, as might ſeparate the ſordes or conſume the callus there ſeated. The beſt method ſeems therefore to be, not barely to add the aloes, myrrh, olibanum, verdigreaſe, *&c.* to the ſubſtance of a fat plaiſter; but rather to mix them with honey or the yolk of an egg: for then they may be diſſolved by the affluent humours, and act with more power on the parts to which they are applied; and as they are thus reduced to a fluid ſtate, they will be more equally diſtributed throughout the whole extent of the ſinus or fiſtula. But as collyria are required to have a ſolid form, in order to convey them through the orifice to the bottom of the fiſtula; therefore, if they do not gradually diſſolve or melt, they will contuſe or preſs the adjacent ſoft parts, like a foreign body, and by that means do more harm than good. Therefore let ſome balſam (for example, turpentine) be taken and mixt with an equal quantity of the yolk of an egg; to which, well incorporated, add honey and other detergents according as the caſe may require; and of theſe let a hollow cone be formed of a ſolid conſiſtence like the ancient collyria, or rather a more fluid form of medicine, which melting with a gentle heat may fill up the whole cavity.

By the injection of deterſives.] It is very evident that the preceding method can take place only where the ſinus or fiſtula is ſimple, and runs in a ſtrait courſe; but when the fiſtula takes a winding courſe, or as it were divides into ſeveral branches, there is then occaſion for other means. *For then*, ſays Celſus, *we ought not to uſe a collyrium, which cures only one part, and omits the reſt: but we are to throw in dry medicines thro' a writing-quill, adapted to the mouth of the fiſtula, blowing through the quill to drive them in. Or elſe the ſame medicines are to be diſſolved in wine; or in mead, if the fiſtula is fouler than uſual; but in vinegar, if it is more callous:*

[d] Exque eo collyrium fieri debet altera parte tenuius, altera paulo plenius. Idque ea parte, qua tenuius eſt, antecedente demitti opertet in fiſtulam, donec purus ſanguis ſe oſtendat, *&c.* *Lib.* v. *cap.* 28. *p.* 330.

callous: and the things thus prepared, are to be injected or poured into the cavity [e]. All thoſe remedies therefore which ſerve occaſionally for the preparing of collyria, being diluted in ſome convenient liquor, are uſually injected through the mouth of the fiſtula; and of this nature there are various forms of remedies to be found in the Materia Medica correſponding to this aphoriſm. But it muſt be obſerved, that theſe injections are often prejudicial, if they are urged in too violently; for then they may eaſily make new paſſages into the panniculus adipoſus, and by that means increaſe the diſorder. Beſides, they are all ſerviceable only inaſmuch as they remove the ſordes, and conſume the calloſity of a fiſtula: but after the parts have been once depurated, they will be rather hurtful, by preventing their union; for even the beſt balſams interpoſed betwixt wounded or divided parts, do like foreign bodies prevent them from healing and uniting. Therefore Celſus adviſes us to uſe agglutinating medicines only, when that coat or ſkin which is ſeated betwixt the opening and the ſound fleſh, being ſubdued by the remedies, is totally ſeparated and diſcharged, leaving the ulcer clean underneath [f]: For then he orders the application of a ſpunge dipped in boiled honey, and condemns the collyria; ſince there can be no danger of one clean part conjoining with another, as we obſerved a little before from the ſame author. Now, the whole internal ſurface may be known to be clean, if it diſcharges a white, ſmooth, and uniform matter, without any ſanies or ichor, and without any fetid ſmell. Thus, for example, a tent or collyrium being introduced into a ſinus or fiſtula, as alſo the plaſter or pledget covering its orifice, is diligently examined by the ſkilful ſurgeon when he renews the dreſſings, in order to perceive whether they are moiſtened in any part with a thin ſanies inſtead of laudable matter; for

[e] Collyrio uti non debemus, quod unam partem curet, reliqua omittat; ſed eadem medicamenta arida in calamum ſcriptorium conjicienda ſunt, iſque ori fiſtulæ aptandus; inſpirandumque, ut ea medicamenta intus compellantur. Aut eadem ex vino liquanda ſunt, vel, ſi ſordidior fiſtula eſt, ex mulſo; ſi calloſior, ex aceto; atque intus infundendum, quidquid inditum eſt. *Ibid. p.* 332.

[f] Ibidem.

then they are assured that all the compass of the sinus or fistula is not yet depurated.

By bandage pressing gradually from the bottom towards the opening.] The best matter corrupts by stagnating, and degenerates into a thin and acrid sanies, see the commentary on §. 402, nº 4.; so that although the internal surface of the sinus or fistula has been well cleansed, new sordes will be again formed, unless the stagnation and corruption of the matter can be prevented. But in order to effect this, an artificial compressure by bandage is of the greatest efficacy, joined with such a posture of the part, as that the collected matter may pass freely out through the orifice of the fistula, and not at all stagnate or be collected in its bottom. Thus we read in Galen [g], that a sinus which descended through the thigh and terminated at the knee, whose original orifice opened above the middle of the thigh, was cured, without making any counter opening, by fixing soft compresses or pillows under the ham, so as to raise it higher than the inguen. But the bandage ought to be such as by a gentle pressure may retain the clean parts in contact. Now as, even in a clean wound of any moment, there is matter daily formed, it ought to be capable of a discharge; and therefore the sinus is not to be compressed by bolsters and bandages all at once throughout its whole length, but by proceeding gradually from the bottom to its opening. Therefore the fundus or lowest part of the sinus is to be diligently sought for. And this may be discovered by a prudent injection of mead, or the like deterging liquor, serving to depurate fistulas, if attention is at the same time given how far and towards what part the liquor tends; which may be also known by beginning a gentle pressure upon the parts below, and continuing the same upwards so as to expel the matter contained in the sinus; for when the pressure made upon the adjacent parts has reached to the bottom of the sinus, the matter will then begin to flow out through its orifice. The part in which the bottom of the sinus or fistula is seated being thus discovered, if the surgeon is assured

[g] Method. Med. ad Glaucon, lib. ii. cap. 10. Charter. Tom. X. p. 386.

assured that the whole internal surface of it is clean, he then applies a compress to that part; byw hich, with his bandage, he determines the pressure so as to reduce the clean parts at the bottom of the fistula into contact; the remainder of the sinus or fistula being only retained loosely with a spiral bandage, while the orifice remains open, to allow of a free discharge to the contained matter. Galen has very well described this method, in treating of the various ways of curing sinuses, where he says, *But the bandage is to begin at the bottom of the sinus, and terminate at the orifice: the circumvolutions of it are to press upon the bottom of the sinus, but so gently as not to give any pain; and are to be laid on more loosely by degrees, till they come to its orifice* [h]. He also observes, that a plaister ought to be applied to the orifice, with an aperture cut in it by a pair of scissars, to give a discharge to the matter when there is any, *&c.* At the following dressings, all the matter is to be gently pressed out before the compress is removed from the bottom of the sinus to which it was applied. And after removing the compress, an attempt must be made to express what other matter is lodged in the adjacent parts; and if any quantity of matter is then discharged, it is a sign that the compress was not applied low enough, but that matter is as yet contained beneath it, and therefore it will be proper to alter its situation: but if no matter is found to discharge itself, the compress is to be applied a little higher up towards the mouth of the sinus; ascending a little at each dressing, and with the like precautions; by which means a concretion of the separated parts will begin in the bottom of the sinus, and proceed gradually towards its orifice. Hippocrates expresses this matter with his usual brevity when he says, *For those parts to fill up which have been wasted, they ought to touch each other without being compressed:* (for that this is the sense of this obscure passage, appears from the commentaries of Galen on this text.) *This contact is to begin in the sound parts, and ter-*

[h] Colligatio autem a fundo sinus quidem incipiat, finiatur autem in ejus orificio. Fasciarum vero circumductiones sine dolore fundum sinus premant, quæ paulatim usque ad orificium (sinus) laxentur. *Ibid.*

terminate at the opening of the ſinus, that what matter is confined may be preſſed or milked out, and no more be collected [i]. The term *milked out* ſeems to be here very proper to expreſs a gradual derivation of the matter from the bottom of the ſinus towards its opening made by a gentle preſſure, in the ſame manner as the milk is forced out by a gentle preſſure continued from above downwards in the milking of a cow, while the orifices of the teats remain open. But the ſigns by which we know that the cure in this caſe ſucceeds, are very well enumerated by Galen, as follows: *But whether or not the bottom of the ſinus is well conjoined, take your diagnoſis from the effluent matter; according as that is either in a large or ſmall quantity, and crude or concocted: As alſo when there is no pain felt about the ſinus itſelf, nor any tumour appears; but the whole part ſeems even, dry, and without pain. But if you ſhould ſee only a ſmall quantity of concocted matter in the orifice, there is ſtill more reaſon to hope for the agglutination of the ſinus* [k]. But though this method may ſucceed very well in many inſtances, yet it is evident enough that it cannot take place unleſs the whole ſurface of the ſinus or fiſtula is very clean, and acted upon by an external preſſure. Therefore when a fiſtula ariſes from an injury of the ſubjacent bone, or has not been firſt well depurated of its calloſity, or if it runs in ſuch a manner that an external preſſure cannot reach to its bottom; the only method that then remains is, to lay open the integuments by inciſion, that ſuitable medicines may be applied to the whole ſurface of the fiſtula.

But the integuments are the ſooneſt divided by inciſion

[i] Quæ abſceſſerunt, ut ſublimia ſint, naturalem ſedem tangere quidem debent, non vero comprimi. Ex ſana vero parte incipiendum, et ad ulcus finiendum, ut quod ſubeſt emulgetur (ἐξαθηλγηται,) aliud autem non colligatur. *Hippocrat. de Medici Officina, textu* 27. *Charter. Tom. XII. p.* 63.

[k] An vero ſinus profundum pulchre conglutinatum fuerit, hæc tibi ſit diagnoſis ex ſanie effluente: ſi pauca vel multa ſit, cocta vel cruda. Præterea ſi circa ipſum ſinum neque dolor ſentiatur, neque tumor appareat, ſed totus locus æquabilis ſit, ſiccus, ac doloris expers. Quod ſi puris probe cocti pauculum in orificio videris, multo magis de glutinando ſinu ſperandum eſt. *Method. Med. ad Glaucon. lib.* ii. *cap.* 10. *Charter. Tom. X. p.* 386.

ciſion upon a grooved probe or director.] The moſt expeditious method of curing a fiſtula or ſinus, is, To convert it into an open ulcer, by dividing the integuments: for the difficulty of the cure does not ariſe ſo much from the internal calloſity, as from the matter which there ſtagnates and corrupts. It appears from the moſt faithful obſervations, and from many caſes of this nature, which I myſelf have ſeen, that fiſtulæ have been cured within the ſpace of fourteen days, barely by inciſion, when other methods have been tried in vain for many months or even years. Celſus being well acquainted with this matter therefore pronounces, *But for the cure of thoſe fiſtulæ which penetrate ſo very deep, or run ſo winding or branched out, that a collyrium cannot be conveyed to the bottom, the cure is then to be rather expected from manual operation than the uſe of medicines; and the cure will be ſtill more expeditious by the operation, if the fiſtula runs tranſverſely under the ſkin, than if it tends directly inwards. Therefore, in a tranſverſe ſubcutaneous fiſtula, a probe or director is to be introduced, upon which it is to be laid open by inciſion. If any turnings are found in the fiſtula, theſe are alſo to be followed and laid open by the knife or director. The ſame is to be alſo done when the fiſtula appears to divide itſelf as it were into ſeveral branches* [1]. There are indeed many boaſted remedies or arcana for the cure of ſtubborn fiſtulæ without cutting: But how little we ought to confide in them, appears from the inſtance of the late French king Lewis XIV. who, being diſordered with a fiſtula *in ano*, had an infinite number of remedies propoſed to him, the principal of which were made trial of by the king's order upon patients afflicted with the ſame diſeaſe, but all without effect: and though a whole year was ſpent in theſe trials, the king at length ſubmitted to, and reſolutely underwent, the operation, even

[1] Adverſus fiſtulas quoque, ſi altius penetrant, ut ad ultima demitti collyrium non poſſit, ſi tortuoſæ ſunt, ſi multiplices, majus in manu, quam in medicamentis, præſidium eſt; minuſque operæ eſt, ſi ſub cute tranſverſæ feruntur, quam ſi recta intus tendunt. Igitur, ſi ſub cute tranſverſa fiſtula eſt, demitti ſpecillum debet, ſupraque id ea incidi Si flexus reperiuntur, hi quoque ſimul ſpecillo et ferro perſequendi ſunt. Idemque faciendum, ſi plures ſe quaſi rivuli oſtendunt. *Lib.* vii. *cap.* 4. nº 1. *p.* 412.

even though the ſurgeon[m] was obliged to lay open all the branches of the fiſtula by many inciſions. But in order that this inciſion may be ſafely performed without injuring the adjacent parts, ſurgeons have contrived various methods. For when the fiſtula runs immediately under the integuments, it may be then ſufficient to introduce a director carefully through the orifice of the fiſtula down to its bottom; and then to make an inciſion by guiding the knife or razor along the groove of the director, ſo as to cut through all the parts which are intercepted betwixt them. But when the courſe of a fiſtula tends more inwards, as it very frequently does when ſeated in the anus, in that caſe it is cuſtomary ſometimes to uſe

A ſilver wire:] Formed of the pureſt ſilver, heated red hot, and ſuffered gradually to cool, to render it the more pliable; and being alſo furniſhed with an obtuſe end like a probe. This is conveyed through the opening of the fiſtula; entering it by degrees, till it has reached the bottom, and one may perceive the obtuſe end under the integuments: then an inciſion being made in that part, the wire is drawn through, and the two ends of it are then elevated, ſo as to remove the integuments from the ſubjacent parts, that they may be ſafely divided either by the ſcalpel or ſciſſors.

This was the method formerly uſed for the curing of fiſtulæ in the anus by inciſion: for they introduced ſuch a probe through the external orifice of the fiſtula, until the ſurgeon could perceive the extremity of it coming into the anus by introducing his forefinger up to the internal orifice of the fiſtula; or if there was no entering an orifice, they boldly perforated the inteſtine with the end of the probe. They then bent the end of the probe with their forefinger, and brought it out through the anus; ſo that by pulling the two ends of the wire, they extended the parts which were to be divided; that is, not only the common integuments, but alſo the ſphincter ani, and part of the inteſtinum rectum, were to be divided in this caſe[n]. Hippocrates

[m] Dionis Cours d'Operations de Chirurgie, demonſt. 4. p. 228, *&c.*
[n] Ibid. p. 285.

es [o] has ſtill another method of curing fiſtulæ of the nus: He orders a probe of tin, the eye of which is to e armed with five threads, circumvolved and tied together with a horſe-hair, which is to be conveyed hrough the orifice of the fiſtula; then the forefinger f the left-hand being introduced into the anus, the nd of the probe is to be bent and brought outward, ntil the thread follows. After the probe is extracted, e orders the two ends of the ligature to be tied in a not, and the patient to be then diſmiſſed, that he may o about his affairs like other people who are well. His intention is ſo to extenuate all the integuments by legrees with a ligature, that they may be at length quite cut through: whence Hippocrates obſerves, that he ligature is to be tightened every day by twiſting, n proportion as it becomes looſer by cutting through he fiſtula; and if the ligature ſhould ſeem to be corupted, a freſh one is to be introduced by tying it to he end of the former, which is to be then extracted, nd the new ligature tightened as before. Celſus juſtly alls this a very tedious method of cure; but whether t is without pain, as he alſo aſſerts, I very much doubt. For he ſays, That the ligature *gradually divides the ſkin which is above the fiſtula; while in the mean time thoſe parts heal which have been left behind the ligature, and thoſe are divided which are thereby conſtringed* [p]. Now, when by the motion of theſe parts in walking the ligature is rubbed againſt the ſides of the fiſtula, it muſt give no ſmall uneaſineſs; or if the ſides of the fiſtula are ſo callous as not to receive any pain from that attrition, then that method will not eaſily divide the integuments, but after a tedious delay recourſe muſt be had to the knife itſelf. But that the preceding method had been often uſed without ſucceſs, is evident from what follows a little after in the ſame place of Hippocrates: For he ſays, *But if the fiſtula ſhould not be thus cut through, introduce a probe, and lay it open as far as it penetrates by inciſion; after which, make an aſperſion*

[o] De Fiſtulis, cap. 3. Charter Tom. XII. p. 142.

[p] Paulatim cutem, quæ ſupra fiſtulam eſt, incidit: ſimulque et id ſanaſcit, quod a lino relictum eſt; et id, quod ab eo mordetur, inciditur. Lib. vii. *cap.* 5. n° 4. *p.* 414.

perſion of flores æris, *and thus leave it for five days*,[q] &c. Celſus obſerves in the place lately cited, that thoſe who are in haſte to have the integuments divided, ought to tighten the ligature: and he likewiſe obſerves, that the ſame diviſion will be haſtened by ſpreading the ligature with medicines which corrode callous parts, but then the pain will be greater; and at laſt he adds, that it may be alſo done by the ſcalpel, the uſe of which will perhaps be neceſſary after all, *&c.* He ſeems therefore to undervalue this method by ligature, as it makes no diſcharge or ſeparation of the foul parts, and often occaſions much pain and uneaſineſs to the patient, as well as trouble to the ſurgeon.

Syringotomus.] This inſtrument is ſo called from its uſe in cutting fiſtulæ, and there are various forms of it deſcribed by authors. It is moſt commonly recommended for the cure of fiſtulæ of the anus. The inſtrument is compoſed of a probe joined to a ſcalpel or razor, ſo that by introducing the former through the fiſtula, a diviſion is then made by the latter, and thus one inſtrument performs what was to be done by two. But the ſyringotomi which are repreſented to us by Scultetus, Van Solingen, Fabricius ab Aquapendente, and others, ſeem to be leſs commodious for this purpoſe, and eſpecially for dividing fiſtulæ of the anus. For here a falciform knife terminates in a probe made of the ſame metal; ſo that this laſt part of the inſtrument has not the pliability which is required to bend the probe by the finger in the cavity of the inteſtine, ſo as to draw it outwards. But the induſtry of modern ſurgeons has corrected the defects of this inſtrument[r]; for they unite a probe of pure flexible ſilver to a crooked knife made of the beſt ſteel, while part of the inſtrument is concealed in a crooked handle.

The fiſtula being thus divided, is changed into an open ulcer; and if then it appears to have many branches, each of them are to be divided after the like manner, con-

[q] Si vero fiſtula non fuerit exeſa, demittens ſpecillum incide, quo uſque illud pervenerit, et inſperge æris florem, et per quinque dies relinque, *&c. De Fiſtulis, cap.* 4. *p.* 143.

[r] Garengeot Traite de Inſtrumens de Chirurgie, Tom. I. cap. 9. p. 286.

that there may be no lurking places for the matter to conceal itſelf in ſo as to ſtagnate and corrupt. But as the internal ſurface of the fiſtula is in this caſe frequently found callous, therefore ſurgeons uſually make ſcarifications in ſeveral places, that the calloſity may be the ſooner removed by the application of digeſtives or corroſives. Even Celſus [x] would have the whole callus to be cut out, after the fiſtula has been laid open to its bottom. But every thing which has been ſaid in the commentary on §. 411. is alſo to be obſerved in this place.

§. 416. FROM what has been ſaid, we may derive a knowledge of the nature, conſequences, and methods of treating buboes, parotids, furuncles or boils, anthraces, carbuncles, phymata, eryſipelata, the meaſles, ſmall-pox, purple ſpots, and the like.

From all that has been hitherto ſaid in the hiſtory of inflammation, and ſuppuration thence following, we may derive a knowledge of a great many diſorders, which may be referred to inflammation and its conſequence as the cauſe, notwithſtanding they are diſtinguiſhed by peculiar names in common practice: And at the ſame time alſo we may be able to deduce their prognoſis and method of treatment from the ſame knowledge. The principal of theſe diſorders are here enumerated; as,

Buboes.] The Greek phyſicians denominated the groins (βουβωνες) *bubones;* and they likewiſe gave the glands there ſeated the ſame name; nor did they alter the name even when the like tumour was obſerved in the glands of the axilla. We even read in Galen of tumours formed in other glandular parts of the body, called by the ſame name: for he ſays, *Alſo the glands which are ſeated in the neck and behind the ears, very often tumefy; and are accompanied with an ulcer about the head, neck, or ſome of the other adjacent parts: but the*

[x] Lib. vii. cap. 4. p. 412.

glands thus tumefied are denominated BUBOES [a]. But at preſent it is cuſtomary with us only to call tumours of the groins and arm-pits by this name. Now theſe buboes are either inflammatory, ſuppurating, or ſcirrhous, all ariſing from the common cauſes of inflammation. But there are alſo buboes which frequently ariſe in the worſt contagious diſeaſes, as in the plague; and ſometimes alſo in the venereal diſeaſe; in which laſt the inflammation is not very ſudden or violent, but uſually continues a long time before it can be either reſolved, or brought to a laudable ſuppuration, frequently reſiſting even the moſt efficacious remedies. Sometimes alſo there is a tranſlation or ſettlement (αποστασις vel μεταστασις) of the morbific matter with very good ſucceſs upon theſe parts, which is then termed a *metaſtaſis* or *apoſtaſis*. And even ſometimes in men who are healthy in other reſpects, theſe tumours ſuddenly ariſe without any topical cauſe, producing firſt an inflammation, and then a ſuppuration: and theſe are the latent efforts of nature, by which ſhe ſeparates thoſe humours from the whole maſs of blood, which might prove of worſe conſequence, without giving any manifeſt ſigns of the latent nature of the diſeaſe. Hence it is that theſe parts were eſteemed by the antient phyſicians as the emunctories or drains of the viſcera; and Galen ſays [b], that the glands very eaſily receive an afflux of the humours, by reaſon of their weakneſs and ſpungy texture. Now if we conſider the ſituation of the inguinal and ſubaxillary glands, they will appear to be well adapted to receive thoſe honours which ought to be diſcharged from the whole habit: for they are placed in the very ſoft adipoſe membrane, almoſt free from all muſcular compreſſion, having very large arteries, veins, and nervous trunks, near them, from which they receive their branches. But theſe glands have ſo great a commerce or conſent with the other branches of theſe nerves, that, when they are injured, theſe glands are often immediately

[a] Quin etiam in collo et ſecus aures ſæpe glandulæ intumeſcunt, natis ulceribus circa caput, collum, vel aliquam ex vicinis partibus. Nominant autem ſic intumeſcentes glandulas BUBONES. *Method. Med. lib.* xiii. *Charter. Tom. X. p.* 297.

[b] Ibid. *p.* 296.

diately inflamed and ſwelled. Thus I have frequently ſeen a very painful paronychia produce a ſudden tumour in the axilla, even though the diſorder was ſeated in the end of the finger. When a woman unfortunately run a needle up under her nail, ſo as to injure the nervous ſubſtance which is there ſeated, with the moſt acute pain; I was ſurpriſed to find, that, in a quarter of an hour after, there was a conſiderable tumour in the arm-pit of the ſame ſide. From hence the reaſon is evident why Hippocrates ſays, *Fevers ariſing after buboes, are bad, unleſs they are* (ephemera's) *but of a day's continuance* [c]. For he here intends that the fever denotes a fruitleſs attempt of nature to expel the morbific matter by abſceſs: And therefore fevers ariſing from ſuch a latent cauſe muſt be very ſtubborn, unleſs they are ephemera's, which run through their courſe, or terminate, within twenty-four hours, and ſignify the ſtrength of nature overpowering the diſeaſe. And in another place he ſays, *Buboes ariſing after fevers are bad, if they decreaſe from the beginning in acute diſtempers* [d]: For theſe then denote an inſufficient endeavour of nature, and in dangerous fevers muſt be always bad; for buboes ſeldom appear in fevers unleſs they are very acute. I remember myſelf to have ſeen buboes in the worſt ſpecies of the ſmall-pox, and in the plague; and all who have written upon that diſtemper teſtify that they are very frequent.

Parotids.] This name denotes a tumour of the glands behind the ears, which is called *parotis* by the Greeks, which is as much as to ſay, an abſceſs behind or under the ear. They are alſo by Hippocrates often called τα παρ ως επαρματα, or ſimply τα παρ ως. What has been ſaid concerning the inguinal and ſubaxillary glands as being ſeated in the ſoft fat, and freed from the compreſſure of muſcles, *&c.* is alſo true concerning the parotids; for they occupy that cavity which we find at the root of the ear betwixt the maſtoide proceſs of the ſkull, and the condyloide head of the lower jaw, from

[c] Febres poſt bubones ortæ, niſi ephemeræ fuerint, malum. *Epidem. lib.* ii. *Charter. Tom. IX. p.* 162. *et Aphor.* 55. *ſect.* 4. *ibid. p.* 170.

[d] Bubones febribus ſuccedentes deteriores, ſi in acutis ab initio decreſcant.

from whence they are extended downward and backward under the lobe of the external ear. They likewise receive large branches from the adjacent external carotid artery. The tumours of these glands appear much more frequently in diseases than buboes; and Hippocrates from thence deduces part of his prognosis in many distempers, as will hereafter appear. But it may be sufficient for us at present only to remark from Celsus, *But under the ears themselves the parotids usually arise, as well in an ill state of health, or after an inflammation in them; as after long fevers, when the violence of the disease tends to that part. This is a kind of abscess, and therefore does not require any different method of treatment: Only this caution is necessary to be observed, That if they swell without a disease, trial ought first to be made with repelling medicines; but if they arise from an ill state of health, it is from something offensive to nature, whence it will be more convenient to maturate and open them as soon as possible* [e].

Furuncle or boil.] This is a very painful inflammatory tumour, seated in the external surface of the body, and slowly tending to suppuration; appearing very red; and, when once the abscess is opened, there generally appears concreted blood in the bottom, whence it is usually denominated a *bleeding-ulcer*. These kinds of abscesses sometimes prove epidemical; and not only invade many men in the same country, but also people of different countries, and appear in different parts of the body. Celsus gives us the following description of a furuncle: *But a furuncle is a sharp-pointed tumour, with inflammation and pain, which are the most violent when it is about turning to suppuration. When this is opened, and the matter discharged, there appears, underneath, part of the flesh turned to matter, part of it corrupted and of a whitish colour, and part of it a reddish colour,*

[e] Sub ipsis vero auribus orire παρωτίδες solent; modo in secunda valetudine, ibi inflammatione orta; modo post longas febres, illuc impetu morbi converso. Id abscessus genus est. Itaque nullam novam curationem desiderat: animadversionem tantummodo hanc habet necessariam, ut, si sine morbo id intumuit, primum reprimentium experimentum fiat: si ex adversa valetudine, illud inimicum est, maturarique et quam primum aperire commodius est. *Lib.* vi. *cap.* 16. *f.* 391, 392.

lour, which part is denominated the ventricle or ſtomach of the boil. There is no danger in this tumour, even tho' no care be taken of it, for it both ripens and breaks of itſelf; but it occaſions a pain, and therefore it may be proper to uſe medicines which ſoon maturate or free it from the pain [f]. As a mild reſolution can never be expected in a furuncle, the whole intention of the cure conſiſts in bringing it as ſoon as poſſible to ſuppuration; and becauſe theſe tumours are generally difficult to bring to a perfect maturation, therefore it is uſual to add ſuch things to emollient applications as are capable of exciting a little greater motion in the part to be ſuppurated: whence Celſus pronounces, that *galbanum is a medicine proper to a furuncle* [g].

Anthraces.] When the external ſkin and ſubjacent panniculus adipoſus are ſuddenly corrupted by a violent inflammation, ſo as to form a dry hard ſcab or eſchar, which, being perfectly dead, ought to be ſeparated from the living parts by ſuppuration, that inflammation is then uſually called *anthrax* or a burning coal. The writers of obſervations teſtify, that this is a frequent diſorder in the plague; eſpecially when the fury of the diſeaſe is mitigated, and the latent virus derived to ſome particular part of the body by victorious nature. But there are two kinds of anthraces deſcribed by Galen, where he treats of the different kinds of inflammation: *When the influent blood is very hot and thick, flowing very rapidly into a part, it burns up the ſkin, and forms an ulcer with a cruſt or ſcab: But all the circumjacent parts it raiſes into a hot inflammation, which is extremely painful. This diſorder is termed* anthrax. *But if the influent blood is black, thick, feculent, and very hot like the former, being alſo mixed with a kind of thin ſanies, it cauſes puſtules in the ſurface of the ſkin, like thoſe*

f Furunculus vero eſt tuberculum acutum, cum inflammatione, et dore; maximeque ubi jam in pus vergit. Qui ubi adapertus eſt, et exiit us, ſubter apparet pars carnis in pus verſa; pars corrupta ſubalbida, ſubabra; quem ventriculum quidam furunculi nominant. In eo nullum ericulum eſt, etiamſi nulla curatio adhibuatur: matureſcit enim per ſe, que erumpit. Sed dolor efficit, ut potior medicina ſit, quæ maturius beret. *Lib.* v. *cap.* 28. nº 8. *p.* 324.

g Proprium furunculi medicamentum galbanum eſt. *Ibidem.*

which are raiſed by fire; which being ruptured, an ulcer is perceived under the cruſt. And this laſt diſorder is alſo an anthrax [g]. The firſt ſpecies of an anthrax is moſt agreeable to the common ſort; but the definition given of the latter kind, denotes a milder ſpecies of the ſame diſorder. The cure conſiſts in procuring a ſuppuration all round the anthrax, ſo as preſently to ſeparate it from the adjacent living veſſels; for the ſubſtance of the anthrax itſelf can never be converted into matter. The moſt emollient remedies only are therefore proper in this caſe.

Carbuncle.] This is related to the anthrax, but ſomewhat milder. The modern ſurgeons generally call by this name an ulceration of the ſkin in ſeveral parts, following after a very violent and painful inflammation, in which there is alſo ſome fragments of the panniculus adipoſus diſcharged from the ulcerations. But the diſorder which Celſus deſcribes by this name, ſeems to have been different from theſe carbuncles: for he ſays, *That it is red, having puſtules ariſing upon the ſurface not very high, generally black, but ſometimes livid or pale, in which there ſeems to be a ſanies, and underneath there is a black colour. The body itſelf appears drier and harder than it naturally ought, and about the edge there is a ſort of cruſt circumveſted with an inflammation. Nor can the ſkin be taken off in that part, but it ſeems as it were faſtened to the fleſh beneath; the patient is ſleepy, and ſometimes taken with a ſhivering or a fever, or both. When the diſorder is once fixed, it ſpreads as it were with roots, ſometimes faſter, and ſometimes ſlower* [h]. The cure which he afterwards ſubjoins

[g] Quando influens ſanguis admodum calidus fuerit, et craſſus in quamcumque partem confeſtim fluxerit, illam adurit, ulcuſque cruſtam habens efficit. Quidquid autem circumſtat, in ferventem inflammationem attollit, et valide dolentem. Vocatur autem ille affectus anthrax. Quod ſi influens ſanguis niger ſit, craſſus, fæculentus, ac fervidus, qualis eſt prior, admixtamque quandam ſaniem habeat tenuem, puſtulas in ſuperficie cutis excitat, ſimiles his quæ ab igne fiunt: quibus ruptis, ſub ipſis cruſtoſum ulcus invenitur. Eſt autem hic affectus etiam anthrax. *Method. Med. ad Glaucon. lib.* ii. *cap.* 1. *Charter. Tom. X. p.* 269.

[h] Rubor eſt, ſuperque eum non nimium puſtulæ eminent, maxime nigræ, interdum ſublividæ, aut pallidæ. In iis ſanies eſſe videtur; infra color niger eſt. Ipſum corpus aridum, et durius quam naturaliter oportet

joins, sufficiently proves that these carbuncles were malignant, and perfectly destroyed or mortified the part which they invaded. For he immediately orders them to be cauterized; which, he adds, may be done without pain, because that flesh is dead; and he orders the cauterization to be continued until every part is sensible of the pain. But how dangerous these carbuncles sometimes were, is also evident from Celsus in the same place; who says, that if this disorder is seated in the stomach or fauces, it often suddenly strangles the patient.

Phymata.] Galen will have phymata to be derived from sprouting (απο του φυεσθαι); for he says, *That physicians have given the name of* phymata *to those preternatural tumours which arise without any external cause, like things which grow out of the earth: but they chiefly call those tumours by this name which are seated externally. But for want of another name they have thus called even broad tumours seated prominent in the natural organs* [i]. From hence the use of this term seems to have been a little uncertain. And that even buboes and other suppurations of the glands were sometimes thus called, is evident from another passage in Galen, where he says, *But there are more especially some spontaneous and sudden inflammations which are called* phymata, *which very soon elevate the skin into a sharp tumour speedily tending to suppuration. Many of them are formed in the groins and arm-pits, because in these parts there are many glands, whose office is readily to receive the excrements of the blood into themselves* [k]. Even Hippocrates terms abscesses

portet. Circaque quasi crusta est; eaque inflammatione cingitur. Neque in eo loco levari cutis potest, sed inferiori carni quasi affixa est. Somnus urget. Nonnunquam horror, aut febris oritur, aut utrumque. Idque vitium subrectis quasi quibusdam radicibus serpit, interdum celerius, interdum tardius. *Lib.* v. *cap.* 28. nº 1. *p.* 315, 316.

[i] Aliis, quæ ex terra progerminant, homines phymata vocaverunt tumores præter naturam, qui omnino sine causa externa proveniunt: sed potissimum ii nominant eos, qui ad externum locum impelluntur. Quia autem aliud nomen non habetur, etiam latos, et paulo naturalibus partibus elatiores (tumores) eodem nomine appellant. *Comment.* 1. *in* vi. *Epidem. Hipp. textu.* 13. *Charter. Tom. IX. p.* 375.

[k] In primis autem quædam phymata appellantur inflammationes nonnullæ spontaneæ, subitissime natæ, citissime in acutum apicem elatæ, et ce-

ſceſſes which ariſe after long fevers about the joints by the name of *phymata* [l]; and in another place he calls by that name a tumour in the urethra [m] itſelf tending to ſuppuration; and in another place [n] he calls a vomica broke inwards. This paſſage of Hippocrates is thus expreſſed by Celſus: *In thoſe who have abſceſſes ſeated in the urethra, which the Greeks call* phymata, *when they diſcharge matter, they begin to recover their health* [o]. The ſame author in another place [p] uſes the name *phymata* barely to denote incipient tumours. But where he treats of the different kinds of abſceſſes, he gives the following more large deſcription of a phyma, when he ſays: *But a phyma is a ſmall tumour like a boil, but rounder and broader, and frequently larger; For a furuncle ſeldom arrives to half the ſize of an egg, and never exceeds it. A phyma alſo ſpreads itſelf uſually broader, but then it has leſs pain and inflammation. When it is opened, there is alſo a matter found in it; but the ventricle is not found here as in a furuncle, but all the corrupted fleſh is changed into matter. It ariſes more frequently in children, and is in them more eaſily removed; in young people it happens more rarely, and is more difficultly cured; but it does not appear at all when age is far advanced* [q].

From all which it is evident, that an inflammatory tumour, ſpeedily tending to ſuppuration, was generally

celerrime ſuppurandæ. Et plurima illorum generatio eſt in inguinibus et axillis, quod in his locis plures ſint glandulæ, quæ hanc naturam habent, ut excrementa promptiſſime in ſe recipiant. *Commentar. in Aphor. 26. ſect. 3. Charter. Tom. IX. p. 122.*

[l] Aphor. 44, et 45. Sect. 4. Charter. Tom. IX. p. 163.

[m] Aphor. 8. Sect. 7. ibid. p. 295.

[n] Aphor. 82. Sect. 4. ibid. p. 191.

[o] Quibus in fiſtula urinæ minuti abſceſſus, quos φυματα Græci vocant, eſſe cœperunt; iis, ubi pus ea parte profluxit, ſanitas redditur. *Lib. iv. cap. 8.*

[p] Lib. v. cap. 18. nº 16.

[q] Phyma vero nominatur tuberculum furunculo ſimile, ſed rotundius et planius, ſæpe etiam majus. Nam furunculus ovi dimidii magnitudinem raro explet, nunquam excedit. Phyma etiam latius patere conſuevit: ſed inflammatio dolorque ſub eo minores ſunt. Ubi divulſum eſt, pus eodem modo apparet: ventriculus, qui in furuncula, non invenitur; verum omnis corrupta caro in pus vertitur. Id autem in pueris et ſæpius naſcitur, et facilius tollitur: in juvenibus rarius oritur, et difficilius curatur. Ubi ætas induravit, ne naſcitur quidem. *Ibid. cap. 28. nº 9.*

rally termed a *phyma*; the knowledge and cure of which is therefore to be deduced from the hiſtory of inflammation and abſceſs.

Eryſipelas.] Concerning this, ſee what has been ſaid in the commentaries on §. 380.

Meaſles.] If we conſider the account given us by Sydenham, who has the moſt accurately deſcribed the courſe of the meaſles from the beginning to the end; it will evidently appear, that, after a preceding fever, there are ſmall inflammatory eruptions, which ariſe in the external ſkin of the face, about the fourth day uſually in the regular kind, but ſooner or later in thoſe which are irregular; which puſtules cohering in cluſters, form red ſpots; and after this the trunk and limbs of the body begin to look red. At length, on the eighth or ninth day, all this redneſs again diſappears; and the broken cuticle appears white and rough upon the ſurface of the body, almoſt as if it was ſprinkled with flour, and the cuticle falls off in little ſcales. From whence it is evident, that the meaſles come near to the nature of an eryſipelas, ſince they only occupy the external integuments, or the internal membranous parts of the body, and are never followed with a ſuppuration, but always diſappear with a ſcaling off of the cuticle.

Small-pox.] Theſe are not eryſipelatous eruptions, like thoſe of the meaſles; but true inflammatory puſtules, tending to a mild ſuppuration when they are of a mild and good kind, or elſe to a gangrene when they are of the worſt kind. They not only invade the external ſurface of the body, but have been ſometimes obſerved likewiſe in the internal parts of the mouth, fauces, ſtomach, and viſcera, as we ſhall declare more at large when we come to treat profeſſedly of this diſtemper. It is ſufficient at preſent for us to obſerve, that they are attended with all the true appearances of an inflammation, ending either in an abſceſs or a gangrene; and that the general rules which have been given for the cure of an inflammation and abſceſs, with that of a gangrene following, do alſo take place equally in the ſmall-pox.

Pur-

Purple or red ſpots.] By this denomination are called all thoſe cutaneous exanthemata or effloreſcences which are ſometimes obſerved after another diſtemper, and are frequently not attended with any injury of the functions; nor can they therefore be well ranked amongſt the other diſorders of this aphoriſm. But of theſe we ſhall treat hereafter, among the ſymptoms of fevers, on §. 723 *et ſeq.*; and it will there appear, that the knowledge and cure of theſe may be deduced from the hiſtory of inflammation.

§. 417. NOR will it be difficult to deduce a knowledge from hence concerning the event of an internal ſuppuration, in which no acceſs can be given to the hand nor to other proper remedies; for many and great diſorders (§. 406, 413.) with collections of matter in the cavities of the body, thence follow.

From all that has been hitherto ſaid concerning abſceſſes and fiſtulæ, it is very evident, how difficult it muſt often be to cure internal ſuppurations, to which neither the eye can penetrate nor the hand reach. For the curative indications (§. 402.) are equally neceſſary in the internal ſuppurations as external ones. But it is often impoſſible, or at leaſt extremely difficult, to perform what is called for by the indications; for neither can the crude humours be maturated or concocted, nor the adjacent parts be mollified or relaxed, by the uſe of ſoftening cataplaſms and fomentations, ſince there is no acceſs given to the hand. It is alſo frequently quite impoſſible to derive the ſuppurating matter outward in theſe caſes, ſo as to diſcharge it in the form of a laudable matter by an opening with a lancet: but, being therefore corrupted and attenuated by [illegible] and ſtagnation, it corrodes the adjacent parts; or [illegible], being abſorbed by the patulent orifices of the veins, infects the blood with a purulent cacochymia, whence follow all the diſorders mentioned at §. 406. But matter contained in an internal abſceſs being daily increaſed,

ſed, will by its weight make new ſinuſes and paſſages, if it is not abſorbed by the veins; till at length, making a way through the internal membranes of the thorax or abdomen, it produces an empyema or a purulent aſcites: And as the matter becomes more acrimonious, and increaſes in quantity, daily, it will corrupt the viſcera, and deſtroy the patient with a ſlow maraſmus, attended with the greateſt miſeries.

§. 418. IF again, the neceſſity or office of the affected part towards life and health be conſidered, the difficulty of the cure and the future conſequence may be eaſily foreſeen.

If we know what internal part of the body is injured by the ſuppuration, we may determine from phyſiology what maladies are to be thence expected, and the more or leſs difficulty which will be met with in the cure. Thus, for example, if the liver is ſuppurated, much danger from thence may be juſtly expected, ſince that is a viſcus abſolutely neceſſary to life and health, as on it depends the formation of bile, ſo eſſential to the buſineſs of chylification. In ſuch a caſe, therefore, a jaundice, cachexy, dropſy, and many other diſorders, are to be feared. Beſides, the ſubſtance of the liver is ſo friable and tender, that almoſt every part of it may by degrees be diſſolved by the long confined acrid matter; whence follow a tabes hepatica and a putrid colliquative flux, which ſoon deſtroy the patient. But if ſuch an abſceſs ſhould open and diſcharge its matter into the cavity of the abdomen, it will produce a purulent aſcites, with the ſame pernicious effects. The open ulcer in the liver will then daily generate more matter, and all the viſcera of the abdomen will be macerated in the ſame matter, and corrupted in a ſhort time. Or if by good luck the matter contained in the abſceſs of the liver ſhould make its way through the integuments of the abdomen outwards, even ſtill the event will be doubtful: For if pure white matter is diſcharged, the patient may recover; but if foul ſordes appear, the patient will certainly periſh, as Hippocra-

crates [r] obſerves. Therefore the hopes are dubious in ſuch a caſe, though it is not abſolutely deſperate. But if an inflammation ariſing in the encephalon turns to a ſuppuration, and no vent is given to the matter, then it will be impoſſible to avoid a deſtruction of the tender fibres of theſe parts, which are abſolutely neceſſary to life; and therefore there can be little hopes in ſuch a caſe. There are indeed ſome rare hiſtories of the wounds in the head which demonſtrate that matter, ichor, blood, *&c.* have been diſcharged, by ways not well known from anatomy, out of the cavity of the cranium, and the patient has by that means eſcaped a deſperate caſe; but perhaps there is not one in a hundred who thus eſcapes. If, again, the vital viſcera contained in the cavity of the thorax, the heart and lungs, are invaded with an abſceſs, it is ſufficiently evident what fatal events are to be feared.

[r] In Coacis Prænot. nº 451. & Aphor. 45. ſect. 7.

The END *of the* THIRD VOLUME.

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